Electrical Review

With Which Is Consolidated WESTERN ELECTRICIAN and ELECTROCRAFT.

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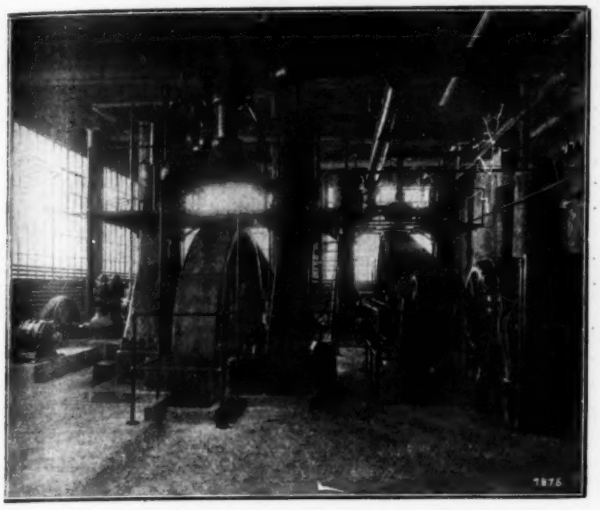


Motor-Driven Compressors and Pumps in Ice Plant.

Electricity in Raw-Water Ice Plants

Central-Station Service for Driving Compressors Effects Marked Saving Over Ice Made by Absorption System—Details of Typical Plants

UNTIL a time not exceeding five years ago practically all ice plants of the larger size were operated by steam engines. The reasons for this condition are explained by C. H. Stevens, of the Brooklyn Edison Company, as follows: (1) These plants were making ice from distilled water and were obtaining the greater part of this distillate from exhaust from their engines; and (2) with this handicap of the engine exhaust to overcome, the central station did not consider the field sufficiently important to adopt new rates, where necessary, to apply directly to this business.

While this condition actually did exist five years ago, there are at the present time at least 100 artificial ice plants of over 90 tons' capacity which are operating exclusively on central-station service in this country and giving the highest satisfaction, both from the standpoint of efficiency and economy.

To occasion this marked change in the situation, it is obvious that the former conditions which were against the central stations must have been met and overcome in a very decisive manner, owing to the large proportion of this business which has been secured since that time.

The determining factors which brought about this change were: the use of multiple-effect evaporators in connection with the distilled-water plants; the advent of the raw-water system of making ice; and central-station rates applying directly to this business.

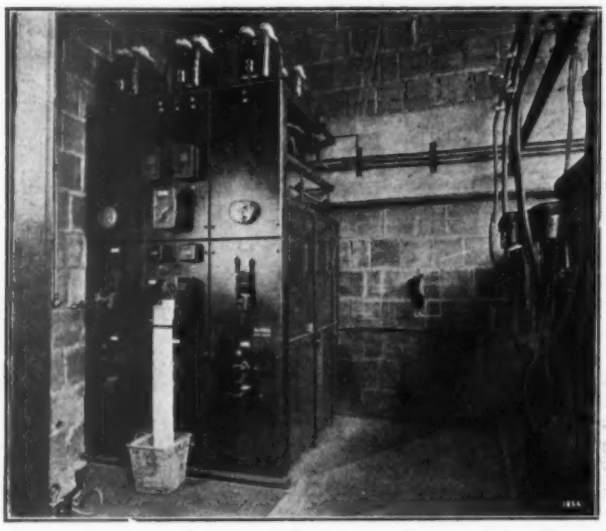
The use of high-pressure multiple-effect evaporators in connection with the distilled-water plants was a most important step in bringing about this change. With this efficient piece of apparatus very high evaporations were obtained—in some instances as high as 50 tons of distillate per ton of coal with an 8-effect evaporator. This made it entirely feasible to drive the compressors and pumps electrically and to produce the distilled water economically direct from the evaporators.

The advent of the raw-water system of making ice was a still further advancement in the science and put the ice plant distinctly within the field of the central station. In this system obtaining distilled water is a secondary and an unimportant item in the cost of production.

With the handicap of steam for distilling purposes removed from both types of plants it was then purely a matter of rates for current that would compare favorably with other sources of power for driving the compressors.

One of the principal advantages of the electrically operated ice plant is that it may be built at or near the center of the territory to which it is to supply ice, irrespective of railroad facilities. This is a very important point, as it is a well established fact that a very large item of cost in the ice business is that of delivery to the consumer. The ideal arrangement is to install plants of from 80 to 100-ton capacity about two miles

apart, so that each plant will supply the territory within a radius of a mile, thus reducing delivery to a minimum. One other point of advantage is that better ice can be produced, as the trouble frequently encountered in steam-driven plants of having oil carry over from the engine cylinder is entirely eliminated.



Switchboard in Ice Plant Showing Curve-Drawing Watt-Hour Meter for Observing Operation.

In view of these conditions the question is how large a proportion of this business can be secured to the mutual advantage of the central station and the manufacturer. The fact that at the present time most of the ice plants are steam-driven should not discourage the central-station men, as it is only recently that this matter has been investigated and gone after by the central station.

Before proceeding further with this discussion it might be well to point out a few physical facts in connection with the manufacture of ice.

(1) Chemically pure water free from air will freeze solid and clear.

(2) Water containing impurities in solution tends in freezing to force impurities out of solution. The slower the process of freezing the more completely is the purification effected.

(3) Ice formed in still water sends out long slender crystals, which increase in number and size, forming a meshwork which gradually becomes a solid mass.

(4) Agitation of water during freezing aids in the separation of impurities and is, therefore, of value in the forming of solid clear ice.

(5) Practically all natural waters contain air and more or less organic or inorganic material in solution. These substances tend to cause the ice formed to be opaque, but as they are frozen out of solution, those that are light rise and collect near the surface and heavier ones stay near the bottom.

(6) The rate of ice freezing increases as the thickness already formed increases. The time required to freeze increases as the square of the thickness to be frozen. The formation of natural ice is from the top down and impurities frozen out of solution fall. This and the motion of the water, especially in quiet-running streams, tend to make natural ice transparent. American manufacturers of ice have always tried to duplicate this clearness, although in foreign countries opaque ice is frequently used commercially.

Distilled-Water Ice-Making.

From the foregoing it will be noted that distilled water will freeze solid and practically clear. This is doubtless one of the main reasons why such a large number of plants now in existence are making ice from distilled water. The plan was to utilize the condensed water from the engines for a large part of the distillate. It might be thought by a casual observer that this was an ideal arrangement against which purchased power could not complete. The situation has been met, however, in two ways, (1) by making raw-water ice, i. e., freezing the water without first distilling it, and (2) in cases where distilled water ice is desired, by securing the necessary distilled water by means of a multiple-effect evaporator. This is an efficient piece of apparatus for securing a very high evaporation of water per pound of coal. With this apparatus six times as much water can be evaporated per pound of coal as with the ordinary boiler. To secure this result, advantage is taken of the fact that water will under vacuum evaporate at a much lower temperature than under ordinary conditions.

Evaporators for ice-plant work are classified broadly into two types—exhaust and high pressure. With the former type we are not directly interested, except that it represents the economy of the steam-driven plant which we must offset with the other advantages of central-station power. In a standard non-condensing steam-driven ice plant the losses vary from 10 to 20 per cent, and hence 100 tons of distilled water in the cans means at least 115 tons produced or handled. Of this amount the compressors and auxiliaries will furnish not over 90 tons, hence a make-up of 20 to 25 tons must be bled from the boilers at the average rate of evaporation of the plant. The exhaust-steam evaporator in single effect with an economy of 8 tons of distillate per 10 tons of steam, supplies this make-up, with a consequent direct saving in coal represented by this evaporation in the boiler less pump charges. With two-effect plants operating from a few pounds above atmosphere to, say, 25 inches of vacuum, the economy may be increased to a ratio of 2.25 to 1 of steam.

If the plant be put upon a standard compound condensing basis a still greater efficiency exists, say 60 per cent of the total coming from the evaporators, and the cost of production is still more against central-station power. Evaporators for the service may be two or more effects, depending upon the price of coal. Their economy may run to as high as 5.5 to 1.

For motor-driven ice plants the problem is merely to produce the distilled water as cheaply as possible, and resolves itself into a consideration of capital investment versus efficiency, and the governing factor is usually the price of fuel. With motor-driven pumps, an eight-effect plant will give an economy of 6 to 1, and hence produce with average western coal and boiler performance, 45 to 48 tons of distilled water per ton of coal. It is seldom economy to exceed eight effects.

When central-station power is being considered by the ice-plant operator the assumption is justifiable that his fuel cost is at least moderately high. With this premise it is easy to point out to him that in securing the benefits of electric drive he is also gaining something from the operating point, some of the benefits being as follows:

(1) He can secure an absolutely oil and air-free distilled water by use of the evaporators.

(2) His cost to produce this water is very low per ton of ice made.

(3) His investment may be so proportioned to his

fuel cost that the cost to produce the distilled water will be a minimum under all conditions.

(4) His boiler plant is reduced to approximately one-sixth of the capacity required with a steam-driven plant.

(5) The amount of condensing water required for his steam condenser is likewise reduced, it being necessary only to condense the vapor from the last effect, for the reason that each evaporator forms the condenser for the previous effect.

(6) The system of heat exchangers employed permits the boiler feed as well as the evaporator feed to be heated to a high temperature which conduces to high economy.

(7) The modern evaporator construction enables the operator to clean the evaporator with less trouble than the average boiler can be cleaned.

(8) The amount of distilled water produced and hence of coal burned may vary with his requirements, whereas, in a steam plant his production of distilled water remains almost constant.

(9) The only water losses in a motor-driven plant are filling losses which are the smallest water losses in the plant.

In distilling equipment of this kind it is essential that all piping be tinned on the inside so as to prevent the distilled water from attacking iron and thus discoloring the water.

Raw-Water Plants.

In order to do away with the necessity of using distilled water many raw-water plants have been built and are giving very good results. One of the items which must have an important bearing on the establishment of such plants will be the character of the water supply. In some sections of the country where the water contains a large amount of mineral substance in solution, it may be difficult to secure clear raw-water ice, but ordinarily there is very little difference in the appearance of distilled-water ice and raw-water ice as manufactured in the best plants.

The methods of manufacture of raw-water ice can be classed under two general heads—the first known as the can system and the second as the plate system. Practically all of the plants now in operation are of the can type, although there are a few of the plate variety.

In a can plant the ice is formed in large cans in which filtered raw water has been placed, these cans being immersed in tanks of refrigerated brine which is being constantly circulated by means of pumps. During the process of freezing the water in the cans is agitated by means of compressed air, which agitation is necessary in order to secure clear ice, as previously explained. The water in the cans is permitted to freeze until the core is reached, at which time the core water is replaced by distilled water and the cake frozen solid, leaving simply a feathery effect through the middle of the cake. This removal of the raw water from the core is necessary in order to secure a clear cake of ice, as, of course, it would be impossible to agitate the raw water until it is entirely frozen. Then, too, the water which has been removed from the core contains practically all of the impurities from the entire can. This process involves the use of between 15 and 20 per cent of distilled water which can be supplied by means of a small multiple-effect evaporator, such as is used in regular distilled-water establishments.

In the plate type of plant hollow plates, through which cold brine or ammonia can be made to circulate, are immersed vertically in tanks filled with water which is agitated. The ice forms gradually on both sides of the plates, thus ridding itself of any air or other impurities on its surface. In the can system these impurities concentrate toward the center, forming an impure core which is removed as previously explained. With the plate system it is not necessary to distill or boil water which is otherwise pure for ice making. The plate plant, however, requires more skill to manipulate it successfully, and is more expensive to install and keep in repair.

In this system when the ice is formed to the desired thickness, it is loosened from the freezing plates by various thawing arrangements. The ice cakes, often 9 feet by 16 feet by 12 inches in thickness, are lifted from the tanks by overhead cranes, and are carried to a table where they are cut to commercial size.

In order that the successful operation of an electrically driven ice plant may be assured, it is necessary that a proper equipment be installed. One of the important features is the type of motor to be used. In all probability the great majority of the plants to be considered will be located in territory in which the central-station supply is alternating current; in fact, nearly all large plants thus far constructed have been equipped with three-phase motors.

There is some difference of opinion as to whether motors should be designed for constant speed or variable speed. In any event, they should be of the slow-speed, slip-ring induction type, and equipped with drum controllers. In case constant-speed work is desired, the resistance to be furnished with the controller need be large enough simply for starting the motor. If at a later time it becomes desirable to operate the motor at variable speed, the only change required will be to install additional resistance. The use of multi-

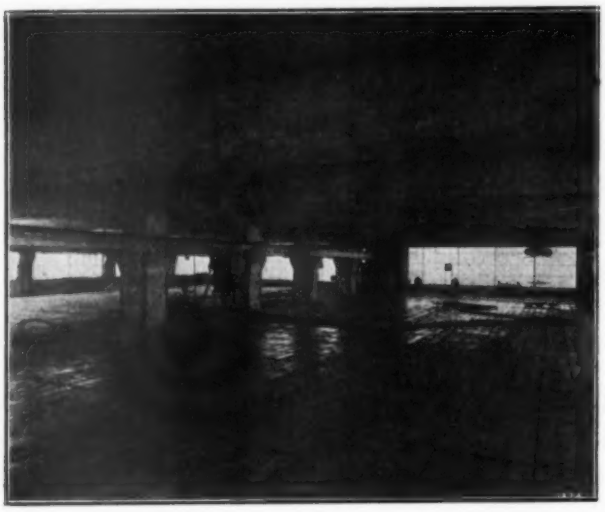
Ice-Storage Room.

speed motors has been suggested for this class of work, but this practice should be discouraged, as the efficiency of the motor at full load is not quite as high as the standard motor, and, furthermore, the power-factor is considerably lower.

While some of the companies have adhered to the standard practice of using 220-volt motors, others have adopted the plan of operating the large compressor motors at primary voltage of approximately 2300 volts, using lower voltage on motors operating the auxiliaries. The efficiencies of three-phase motors are the

same at either 230 volts or 2300 volts. The factors involved in making a choice are the economies in operation due to the elimination of transformer losses, and the comparative costs of first installation. The use of primary voltage on motors, however, introduces a certain risk to attendants which many of the large companies hesitate to assume.

The question is often asked whether or not an electrically operated plant can be made to operate as cheaply as a steam-driven plant when the location is favorable to the steam plant, that is, when ample railroad facilities are available so that coal can be brought in under the best conditions. This question is best answered in the words of one of the largest ice operators in the country, who has a number of distilled-water ice plants, both steam and electric. He states that under his conditions of operation there is practically no difference in the cost of manufacture under the two systems. Under the electric plan of operation, however, he can locate plants to best suit his needs, and, furthermore, the possibility of contamination from oil is removed, which is a point of much value.



Tank Room with Motor-Driven Can Filler.

Details of a Typical Installation.

The Greater New York Ice Company's plant in Brooklyn, N. Y., has now been operating for a little more than a year. Its power is received at 6600 volts from the Brooklyn Edison Company's lines and transformed to 440 volts for motors and 110 volts for lighting. A curve-drawing watt-hour meter is provided on a panel of the switchboard. The record of this instrument gives an excellent check on the plant's performance since the load should be nearly constant.

The main equipment of the plant consists of two large compressors: one a 16 by 18-inch York driven by a 200-horsepower Westinghouse squirrel-cage motor of 480 revolutions per minute, and one a 14 by 16-inch York driven by a 150-horsepower General Electric motor of 725 revolutions per minute. In the same room is a 25-horsepower Westinghouse motor that operates two machines, one being a 500 gallons per minute pump with a 70-foot lift, and the other a small auxiliary 24-ton York compressor. This latter machine is used for keeping the rooms and tanks cold nights and Sundays in winter when the plant is shut down; and since the pump is only used in summer, one motor does for the two machines. A three-horsepower motor operates a pump serving a tank on the roof with purified water; it has an automatic controller and is started and stopped by the fall and rise of the level in the tank. Two air compressors, each driven by a 40-horsepower motor, provide the air for agitating the water while freezing.

There are 2802 cans altogether, two-thirds on the second floor and the others on the floor above. Both city water and well water are used after being filtered and purified. The resulting water is so good that it makes perfectly clear ice without sucking the cores. Eight two-horsepower vertical motors drive agitators for circulating the brine on the main floor and four on the floor above. The hoist for pulling the cans is also electrically operated. The total capacity of the floors is 250 tons in 24 hours.

The ice is dropped into the storage room by means of automatic elevators and is shot out through chutes to the delivery platform.

Had full steam equipment been provided, the cost would have been about $85.00 per horsepower installed. With electricity, the cost is less than one-third this sum.

New York Electrical League Applies for Jovian Charter.

The New York Electrical League held its monthly meeting at Stewart's on Wednesday, December 5. James M. Wakeman, vice-president, occupied the chair. Mr. Wakeman announced that since the previous meeting of the league, the Board of Directors had met and had applied to the Jovian Order for a charter. After Frank Watts had explained to the meeting why this action had been taken, a motion was carried unanimously endorsing the action of the Board of Directors in applying for the charter.

Mr. Wakeman also announced that at the Board of Directors meeting the following were appointed a nominating committee: George Pells, chairman; Martin Oberlander and Elliot Reid.

This committee will nominate the officers for the ensuing year. Election will take place at the January meeting of the league.

George Pells was elected First Tribune for New York. James Betts, chairman of the Liberty Loan Committee, made a report showing that the league had purchased liberally of the second Liberty loan.

The speaker of the day was Roy B. Woolley, who has recently returned from service in France with the French Field Ambulance Corps. Mr. Woolley's most interesting address gave the members an excellent idea of the conditions existing on the French front.

Electrical Service at Boyne City, Mich.

Boyne River Power Company and the Boyne City Electric Company, allied concerns, both do business at Boyne City, Mich. The former operates a power plant on the Boyne River, the equipment of which consists of two 250-horsepower Leffel water wheels, and two General Electric 250-kilowatt generators, and an auxiliary steam plant of 100 horsepower for use in an emergency. The latter company is a service corporation and secures electric energy from the Power company for all classes of lighting in the city, and to operate pumps by which the supply of water for all purposes is provided. The general superintendent is C. T. McCutcheon, at Boyne City; the general office of the two companies is at Grand Rapids, C. C. Folmer being secretary and treasurer.

Construction Details of 66,000-Volt Line

Severe Topography of Country Traversed Imposed Unusual Conditions in Building Wheeling-Moundsville Line by Wheeling Electric Company

THE 66,000-volt transmission line recently placed in service between Wheeling and the mining settlement of Moundsville, Va., by the Wheeling Electric Company, Wheeling, W. Va., is of interest because of the rather severe topography of the country traversed, and indicating the manner in which the steel structures were chosen to conform most economically with local ground conditions. This transmission line is only a comparatively short line, 8.5 miles in length, and yet four different types of towers are used, and some of these are modified to suit special local conditions, such as long spans, steep slopes, or unfirm foundations. The purpose of the line is to transmit three-phase energy from the Forty-second Street power house at Wheeling to the transformer station at Moundsville, where the voltage is stepped down from 66,000 volts for general distribution purposes. The line has been designed to carry two three-phase circuits and one overhead grounded conductor. At the present time, however, only one circuit and the overhead ground wire have been installed.

Engineering and Topography.

The location of the line with respect to its commencement and termination is shown in Fig. 4, which shows also that while not following the most direct path, the transmission line makes comparatively small detours. Fig. 1 shows profiles of ground traversed by the line, the location of towers and form of conductor used. This profile indicates the mountainous nature of the country, and emphasizes the influence of topography upon choice of transmission line structures and conductors. The profile was obtained by running direct levels over the entire length of the line, the result giving the clearances between the insulators and ground on both sides of the center line. Second and third profiles were then run one on each side of the former center line of the right-of-way, and six feet distant. With these data on hand a preliminary survey was made before the commencement of construction work. The final survey occupied three weeks, and was carried out by a corps of four men.

Transmission-Line Structures.

There are 82 steel structures on the entire line, chosen with regard to length of span, grade and characteristic of foundation. All the steel towers, which were supplied by the American Bridge Company, are thoroughly galvanized to eliminate the necessity of the periodic two or three-year painting.

The first half-mile of line which passes from the power house at Forty-second Street through the streets of Wheeling is carried on six C and six D-type steel poles. The C-type pole is used for suspension insulators, the D-type for tension insulators. These poles are built up on 3-foot square-base angle structures, and are 65 feet in height, giving a distance of 50 feet between the lowest cross-arm and ground. The three cross-arms are each 11 feet 8 inches over all and extend 4 feet 4 inches from each side of the poles. The footings of these poles are simply extensions of the main structure, both are set in concrete, the foundations being 5 feet square and 8 feet in depth for the type C and 9 feet in depth for the type D.

On the remaining 8 miles of transmission line 29 A-type and 40 B-type steel towers are used. The A-type tower is 56 feet, 11 inches over all, is 41 feet, 8 inches from base to lowest cross-arm and has a base 10 feet square. It is used for straight sections of line, for angles not exceeding 3 degrees, and for carrying suspension-type insulators. The footing for the A-type towers consists of heavy steel plates 2 feet 6 inches square and set 7 feet below the surface of the ground, the footing plates being connected to the four corner angles of the towers by bolts. The B-type tower is a heavier tower, used on angles larger than three degrees, for long spans and for carrying tension insulators. This tower has an over-all length of 58 feet,

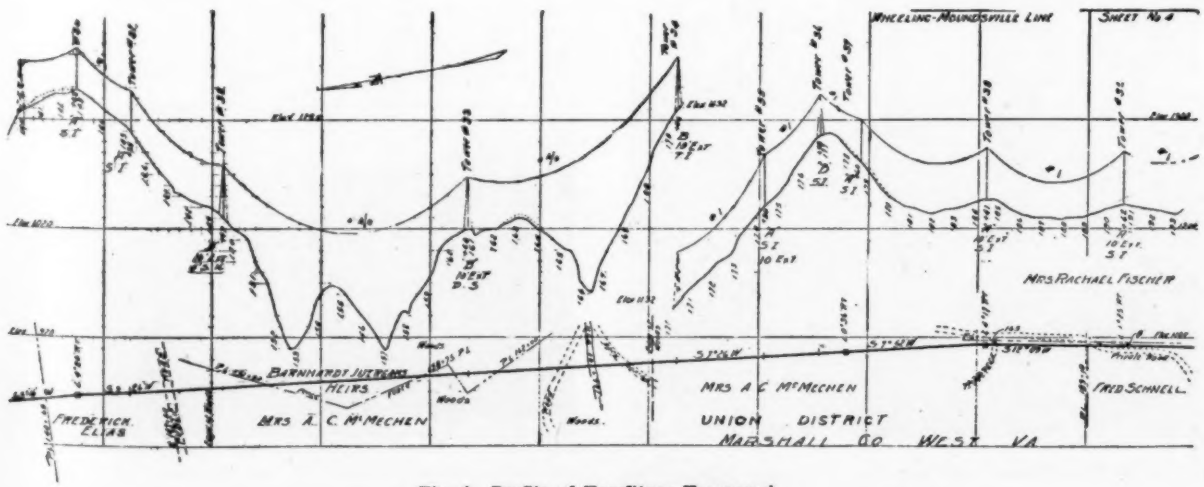


Fig. 1. Profile of Terrfitory Traversed.

is 40 feet from lowest cross-arm to the base and has a 12-foot base. The cross-arms of both the type A and B towers are spaced 6 feet 6 inches apart, the top and bottom arms being 11 feet 8 inches and the middle arm 15 feet in length. With these towers 10 and 15-foot square base extensions are used, to enable maintaining uniform clearance between the lower conductor and ground. In the case of 14 towers a standard 4-foot side-hill extension is used, which permitted reduced cost for excavating the foundations. The ground conditions were such that it was necessary to use concrete foundations with three of the towers.

The Ohio Brass Company's type O. B. No. 9194 disk insulators are used throughout the entire length of the line. For the length of line carrying the 3-strand No. 1 copper wire five disks in series are used for suspension and six for tension. For that portion of the line carrying the 4/0 copper-clad steel wire, which by referring to Fig. 1 will be seen to be those portions of the line where the longest spans occur, two parallel strings of five disks in series each are used for suspension and two parallel strings of six each in series for tension.

The conductors were chosen with regard to length of span. For the shorter spans, see profile in Fig. 1, 13 miles of No. 1 three-strand semi-hard-drawn copper wire is used, having a cross section of 83,690 circular mils and weighing 0.255 pounds per lineal foot. For the longer spans 4/0 "Copperweld" copper-clad steel wire is used, having a cross section of 211,600 circular mils and weighing 0.62 pound per lineal foot. This wire was manufactured by the Page Steel Wire Company, Monessen, Pa. Some 12.5 miles of this copper-clad wire is used, which serves to further emphasize the number of comparatively long spans in the line. For the overhead grounded conductor, of which about 9 miles is used, Siemens-Martin 3/8 double galvanized stranded steel is used. The ground wire is fastened directly to the steel structure, as can be seen in Figs. 2 and 3.

Constructing the Line.

A number of factors combined to make the construction of this line a matter not free from difficulties. The mountainous nature of the land, the high rock content of the soil, and the long spans each gave rise to difficulties. In addition, the weather was part of the time extremely unfavorable, rain and snow storms and bitter cold causing numerous cessations of work, one for a period of about one month. A local

Fig. 2. B-Type Tower With Side-hill Extension Carrying 781-Foot Span.

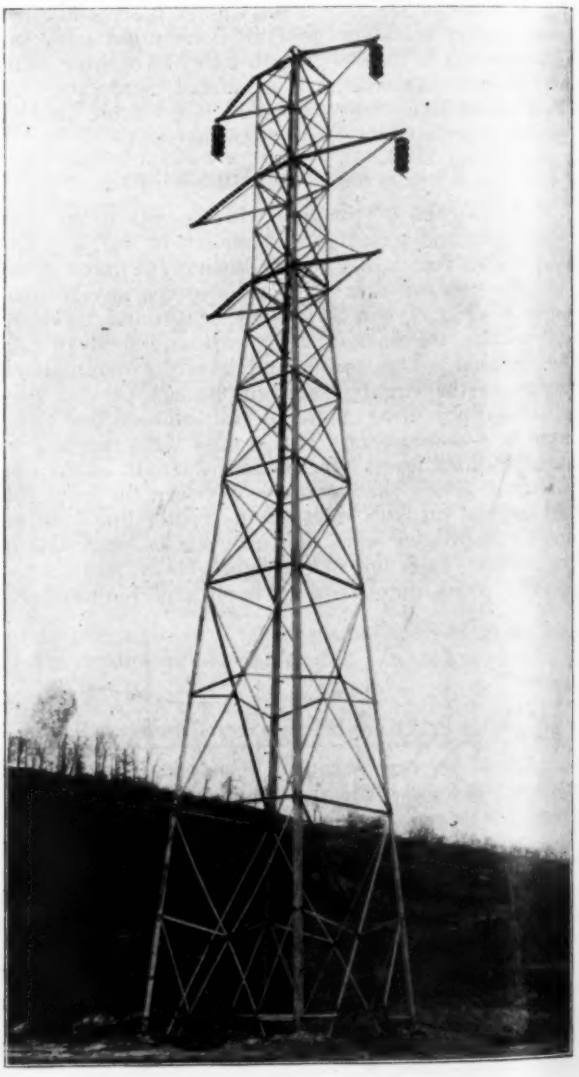


Fig. 3. A-Type Tower Carrying Insulators in Suspension.

labor shortage also added its quota to the difficulties and delay.

All material for the line and for installing it was shipped by railroad to either Wheeling, Moundsville or McMechen, this latter being intermediary between the two ends of the line. From these supply bases the material was transferred to wagons and distributed by construction crews along the right-of-way. Perhaps a better idea of the amount of work this necessitated is obtained from the accompanying table, which gives the weights of the different structures:

	Pounds, each.
50-ft. Type C. pole	3,700
53-ft. Type C pole	3,850
50-ft. Type D pole	5,800
53-ft. Type D pole	7,000
Type A tower	4,300
Type B tower	10,400
10-ft. square extension A	850
15-ft. square extension A	1,200
10-ft. square extension B	1,900
15-ft. square extension B	2,400
4-ft. side hill extension A	350
4-ft. side hill extension B	600
4-ft. side hill ext. to 10 sq. A	400
4-ft. side hill ext. to 10 sq. B	700
4-ft. side hill ext. to 15 sq. B	750
10-ft. setting template, total	4,000
50-ft. Moundsville substation, total	36,600

In all, for the 8.5 miles of line 684,060 pounds of steel was transported to its various destinations along the right-of-way and erected. In addition to the steel and a comparatively small amount of concrete, 13 miles of No. 1 three-strand semi-hard drawn copper wire, weighing 0.255 pounds per foot; 12.5 miles of 4/0 Copperweld copper-clad steel wire, weighing 0.62 pound per foot; 9 miles of Siemens-Martin 3/8 double-galvanized stranded steel wire; and one carload of insulators and hardware material had to be handled.

Actual construction of the transmission line commenced on October 23, 1916, at the Moundsville end

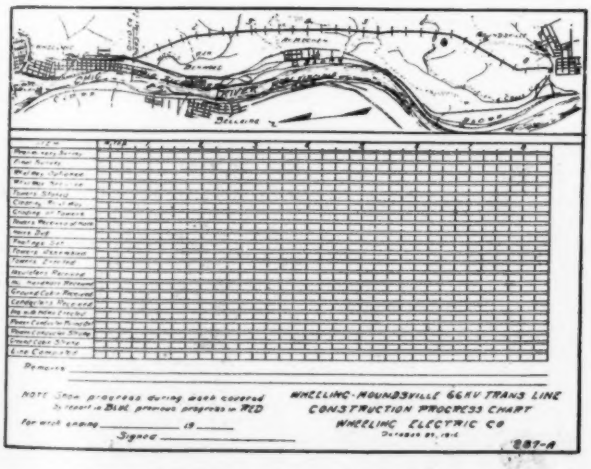


Fig. 4. Location of Line and Progress Chart.

of the line, a local labor shortage necessitating importing negro labor from the South. A small gang went ahead to clear the underbrush and cut down all timber within 50 feet of either side of the center line of the right-of-way, followed almost immediately by a gang for excavating for the towers and poles. About this time tower footings were distributed to their respective locations and assembled. On November 2 setting up the bases for the towers was started. To assure their being correct each base was leveled by transit. Progress was rather slow on account of the ground encountered consisting of about 50 per cent rock, and the prevalence of rain and snow and bitter cold. The bases were, however, completed by January 15, 1917, there being altogether bases for 68 towers and 12 for steel poles.

It was on January 20, or five days later, that the erection of the steel towers started, and was completed by the end of March, about one month during the interim being lost on account of the necessity of abandoning the work due to bad weather. The stringing of wire was commenced from the Wheeling end on April 2, and at the rate of about one-third mile per day the entire circuit length of line of 8.5 miles was strung and sagged by April 27. The three conductors for one circuit, and the ground wires were strung at this time. During the stringing of wire the weather was unfavorable, making progress slower than otherwise it would have been, but the greatest difficulty was due to the number of long spans. In all there were 11 spans over 1000 feet in length, the three longest being 1935, 1874 and 1754 feet, respectively. A careful record of the work done and its progress was made up every week, the form of chart used being shown in Fig. 4.

Much of the information on the construction of this transmission line was obtained from an article on the same subject by L. H. Morris in a recent issue of the American Gas & Electric Company's bulletin.

Merger of Ohio Central-Stations Completed.

The Northern Ohio Public Service Company has taken over the old steam-electric plant at Bowling Green, Ohio, which formerly was operated in connection with an electric railway, and is rehabilitating it as a central-station plant for lighting and power service. The two 255-horsepower Stirling boilers, installed under a receivership some time ago, will remain in service; and new equipment being added consists of two 350-horsepower Stirling superheaters, a 1000-kilowatt turbogenerator of General Electric type, and the Spray Engineering Company's spraying system for cleaning and cooling the generator ventilating air; also, a surface condenser to serve the original 500-kilowatt generating unit, which is driven by a Cooper cross-compound engine that was a part of the original installation. The superheaters, spraying equipment and piping were sold by the Power Equipment Company, Toledo. This project is one of the Insull interests of Chicago.

Kentucky Utilities Considers Rate Increase.

Increased cost of operating may compel the Kentucky Utilities Company to make certain increases in rates for electric service, especially in cases of large consumers, according to a statement by F. A. Bacon, of Philadelphia, vice-president of the company. The company and City Council of Versailles, Ky., have signed a renewal of the city street-lighting contract for a period of two years. This is on the basis of $75 a year for the arc lights; $25 a year for 100-candlepower incandescents and $20 for 60-candlepower incandescents, five incandescent lights and the city hall lighting being free.

Contract Placed for More Ships.

The United States Shipping Board Emergency Fleet Corporation has placed a contract for 36 3500-ton ocean-going vessels with the American Shipbuilding Company. The contract price is said to be $700,000 for each vessel, or a total of $25,200,000. Construction will be on the Great Lakes and deliveries will be made next July or August.

Electrically Operated Purification Plant at Great Falls, Mont.

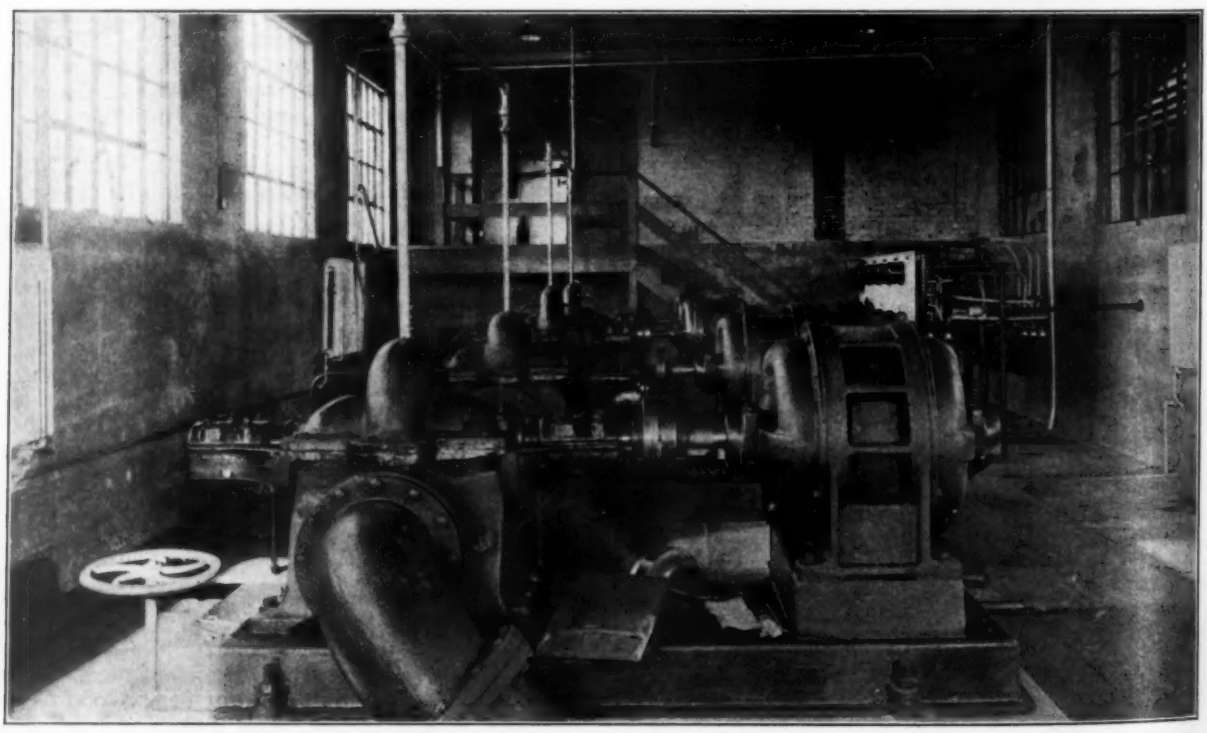
Central-Station Service Effects Economies in New Pumping Station—Details of Equipment and Operating Features

GREAT FALLS, with a population of about 30,000, has for years used Missouri River water in its raw state for both domestic and fire uses. An agitation for a pure water supply has extended over a period of about ten years, this being due to the fact that the water was turbid at certain seasons of the year and the typhoid cases in the city were also above normal, and about two years ago the State Board of Health took an interest in the health conditions of the city, believing that much of the typhoid of the city was due to using the Missouri River water without adequate purification.

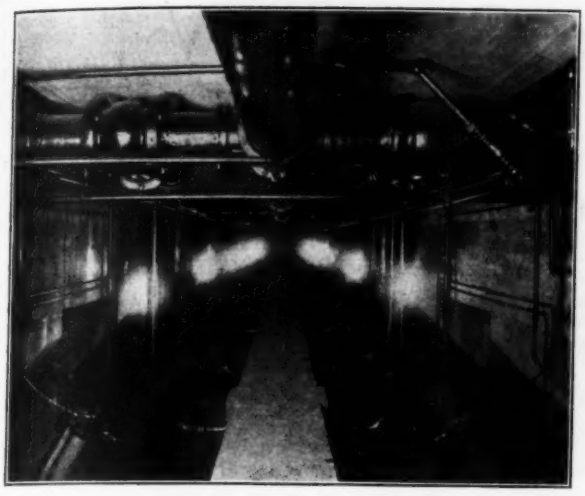
After bonds for a purification plant had been voted for the project the engineers employed by the city, Burns & McDonnell, Kansas City, Mo., were instructed to prepare their plans and specifications to cover both water softening and purification. A citizens committee was appointed outside of the City Council to take charge of the execution of the work, and this committee, composed of the leading citizens and several local engineers, passed upon the plans, specifications, receiving of bids, final tests and other details of the entire work.

The new water-purification plant should be considered in connection with the water system as a whole. The purification feature constitutes the intermediate function between the low-duty pumps that take raw water from the Missouri River, and the high-pressure pumps which receive the purified water and force it through the city mains. The supply, purification and distribution of the city's water are controlled by the dual pumping station situated on the right bank of the river. The pumps are all electrically driven, current being supplied from the generating stations of the Montana Power Company. By this arrangement of having two pumping plants in one station, with the filtration and treatment plant between them, the required daily supply of 12 million gallons of water is handled twice every 24 hours—first as raw river water, and secondly as purified water.

Before any plans were made for a purification plant the city had for several years been operating its plant of five Worthington two-stage, electrically driven pumps by which the water supply was taken from the river direct, and from wells near the river, and forced through the distributing system. This same plant is still intact and serves now for delivering the treated water from the purification plant into the city supply pipes. The largest in this installation is a two-stage pump of a 24-hour capacity of 4,000,000 gallons, direct-connected to a General Electric motor of 450 horsepower, at a pressure of 2200 volts and a speed of 1800 revolutions per minute; the next is a two-stage turbine pump of 2,000,000-gallons daily capacity, direct-connected to a General Electric 150-horsepower motor, running at 2200 volts, with a load speed of 1170 revolutions; the other three are of the same type and capacity as the one last described, and



Motor-Driven Pumps in Great Falls Purification Plant.



Two Views in Water Purification Plant at Great Falls, Mont.

each similarly equipped with a motor. It is so arranged that this plant's suction pipes may be diverted from the pure-water reservoir and connected to large-supply wells on the banks of the river in case of a conflagration in the city. The pure-water distribution is equalized by a half-million gallon reservoir on Boston Heights, which is 230 feet above the level of the river.

When it was decided to construct a purification plant, it became necessary to build an extension to the original pump station and install a plant of low-service pumps for pumping raw water from the river up to the purification plant. The new building erected is 24 by 60 feet in size, of reinforced concrete. The equipment installed consisted of four Platt Iron Works, motor-driven, centrifugal pumps of a total capacity of 12 million gallons in 24 hours. The first two units consist of two 12-inch pumps, each of the capacity of 2750 gallons per minute, and each direct-connected to a 50-horsepower motor, running at a voltage of 2200, and a load speed of 1160 revolutions; the third and fourth units comprise two 8-inch pumps of 1400-gallons capacity, each driven by a 30-horsepower motor, 2200 volts, and load speed of 1135 revolutions. These pumps operate against a head of 47 feet, and discharge into the mixing chamber in the treatment plant. The pumps in the two plants of the dual station have been in operation for some time, as also the filtration and water-treatment plant.

The purification plant consists of, first, a reinforced-concrete mixing chamber; and owing to the softening requirements the mixing chamber was designed with a view of a thorough mix and a long travel of the water before passing into the settling basins. To insure the water passing through the mixing chamber and to overcome the loss in friction through baffle walls, the mixing chamber stands at a level about three feet higher than the settling basins. The travel through the mixing chamber is 1660 feet, requiring a time in the mixing chamber of thirty-six minutes when pumping at the rate of twelve-million gallons per day. When pumping at a more or less rate the length of travel and velocity through the mixing chamber can be maintained at various rates by changing the baffle walls or cutting out a portion of the mixing chamber. The velocity through the mixing chamber of 0.77 foot per second prevents any sediment depositing in the mixing chamber.

The thorough mixing that is given in the mixing chamber accomplishes considerable clarification before the water even reaches the end of the mixing chamber, and it therefore passes into the settling basin with this clarification process well started. The water has a retention period in the settling basins of about eight hours when filtering at the rate of twelve-million gallons per day; the water, therefore, reaches the filters in a well prepared condition for filtration. An examination of the residue in the bottom of the settling basins does not show any undissolved or unused chemicals, and experiments were conducted for about thirty days to determine the minimum amount of chemicals that could be used to obtain the most efficient results. It was found that from 0.6 to 0.7 grain of sulphate of iron was the amount of chemicals required for thorough sedimentation during ordinary stages of the water. This quantity will undoubtedly have to be increased during the highest turbidity stages of the water. Although the natural lime in the water is small, with the thorough mixing accomplished in the mixing chamber it was found that it was not necessary to add lime to the water, and the omission of lime is a large saving in the annual cost of operation. This saving in lime is undoubtedly accomplished by the thorough mixing the water receives in the mixing chamber. Chemicals for both water purifying and softening are fed by dry-fed machines, and are connected with a Venturi meter and so arranged that the chemicals fed are in direct proportion to the water used. It is believed that this saves greatly in the amount of chemicals used, as well as in getting a uniform strength of solution.

The filters are arranged in eight units, four on each side of the main filter floor, partially exposed so that the water can be observed. The filter units are of 1.5 million gallons capacity each, and cleaning is accomplished through the use of air and water and all valves used for cleaning and controlling are electrically operated.

The motor-driven air blower has a capacity of 2600 cubic feet of free air per minute at four pounds pressure and is operated by a 50-horsepower squirrel-cage electric motor. The blower is of the Root type and has a capacity and pressure sufficient to give a uniform agitation of sand by the air. A part of the equipment is a 24-inch Venturi meter, recording the rate of flow in gallons per day, with a chart recorder giving an unbroken autographic record of the rate of flow from hour to hour, and a counter-dial showing the total gallons of water that have passed through the meter.

The Magnetic Circuit—V

Meaning of Magnetomotive-Force Gradient—Calculation of Flux Produced by a Helix or Solenoid—The Effect of Magnetic Leakage

By TERRELL CROFT

This is the fifth and concluding section of this article whose publication was begun in the issue of November 17. Taken as a whole, it is about as simple and clear an explanation of the fundamental relations in a magnetic circuit as it is possible to present without the use of higher mathematics. It gives a good working knowledge of the subject to enable intelligent calculation of at least the simpler problems.

THE real significance of magnetomotive-force gradient (H) should be thoroughly understood. In all the preceding text (except near the end of the last section of this article) only the phenomena relating to entire magnetic circuits or considerable portions thereof have been considered. Now, it is often desirable, particularly for the purpose of comparison and computation, to consider unit portions, that is one-inch cubes, of uniform magnetic circuits and to examine the magnetic performance of these unit cubes. In fact, reference tables and graphs (like those of Table I and Figs. 14 and 15 in the issue of December 1, 1917) which show the magnetic properties of the magnetic-circuit materials, are always so compiled that they, as will be shown, give data applying to these one-inch cubes. Obviously, magnetic-properties data and tables can be useful for general work only if compiled on the unit basis.

In the example which follows it will be shown that magnetomotive-force gradient, H, in any uniform magnetic circuit is really the *specific magnetomotive force* for that circuit. That is, H is really the *portion* of the total impressed magnetomotive-force which produces the flux in a unit cube (one-inch cube) of the magnetic-circuit material. It is the magnetomotive force impressed on a one-inch cube and to which the flux in that unit cube is due.

As an example, consider the magnetic circuit of Fig. 18, *I*. Assume that it is desired to produce a flux ϕ of 200,000 lines in this circuit. It will be assumed that there is no magnetic leakage and that the permeability of the circuit material is 4000 perms per inch cube. The average length of the circuit is 20 inches and its cross-sectional area is 4 square inches. Then to develop the flux of 200,000 lines, the magnetomotive force in ampere-turns, would, from (26), be:

$$(a) \qquad I \times N = \frac{\phi \times l}{\mu \times A} = \frac{200{,}000 \times 20}{4000 \times 4}$$

$$= 250 \text{ ampere-turns.}$$

Hence, in this circuit, the magnetomotive-force gradient would, from formula (20), be:

$$(b) \qquad H = M \div l = I \times N \div l = 250 \div 20$$

$$= 12.5 \text{ ampere-turns per inch length.}$$

We will now proceed to show that this 12.5 ampere-turns or H is actually the magnetomotive force impressed on each unit or one-inch cube of this magnetic circuit. If the magnetic circuit of Fig. 18, *I*, were cut through at the plane *ABC* and "straightened out," its equivalent would then be, as shown at Fig. 18, *III*, a prism 20 inches long and 2 inches square. This prism can be considered as being composed of 80 unit cubes as shown.

Let us compute the magnetomotive force which would be required to produce the same flux that is carried in *I* in any one of these unit cubes. Since the total flux in *I* is 200,000 lines, and the cross-sectional area is 4 square inches, the flux through any one cube would be: $200{,}000 \div 4 = 50{,}000$ lines. Now compute the magnetomotive force, in ampere-turns, necessary to develop 50,000 lines through one of the cubes. Each cube has a length of one inch and an area of 1 square inch, thus:

$$(c) \qquad I \times N = \frac{\phi \times l}{\mu \times A} = \frac{50{,}000 \times 1}{4000 \times 1}$$

$$= 12.5 \text{ ampere-turns.}$$

Note that 12.5 ampere-turns per inch length was the result obtained in (*b*) for H and that the result in (*c*), the magnetomotive force required for a unit cube, is 12.5 ampere-turns, which is, of course, for a

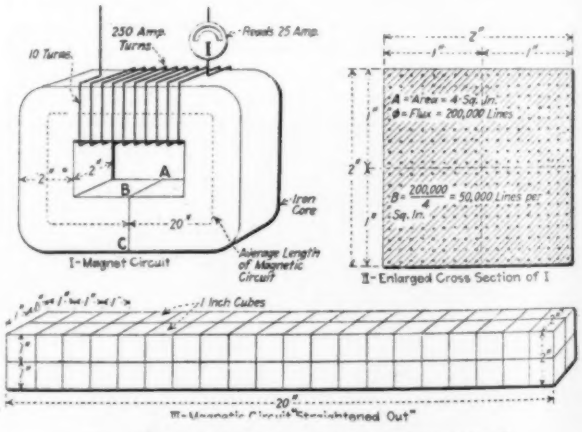


Fig. 18.—Explaining a Unit Magnetic Circuit.

one-inch length. It will then be evident from a consideration of the facts brought out in this example that H is actually, in a uniform magnetic circuit, the specific magnetomotive force, that is, the magnetomotive force required to develop the flux in one unit cube of that circuit.

It follows therefore that, in a uniform magnetic circuit comprising one unit cube, B or flux density (or flux through a unit cube) may be considered as the effect, the cause of which is H or magnetomotive-force gradient (magnetomotive force impressed on a unit cube). A similar situation exists in every magnetic circuit in which ϕ or total flux is the effect of which $I \times N$, or total magnetomotive force, is the cause.

Flux Produced by a Helix.

The flux produced by a helix in air will now be considered. If current flows around in a helix like in one of those of Fig. 19 (same as Fig. 4 on page 843 in the November 17 issue) it will create a magnetic field or flux. A considerable portion of the flux lines generated by such a helix will circulate the entire length of the space inside of the helix and complete their circuit entirely around it. However, some lines will leak out and follow shorter paths between turns.

It follows, then, that the number of lines of force threading the air core of a helix will be different through different cross sections along its length. More lines will pass through the air core at the center of the helix, for example at *B*, in the first helix of Fig. 19, than thread the core at any other point along its length. It can be shown experimentally and mathematically that the number of lines in the air core at the center of the helix is approximately twice the number in the core at the ends, as at *A* and *C*, Fig. 19, *I*.

Moreover, with the same current flowing in both cases, if helix *I*, Fig. 19, be pulled out until it is twice as long, as in *III*, the number of flux lines in the air core at the center and the number of flux lines at the ends *G* and *I* will be only half as great as at the corresponding locations in the shorter helix of *I*. The reason for this is that *I* and *III*, each has the same number of ampere-turns, hence develops the same total magnetomotive force. But the length of the core—or the length of magnetic circuit—in which the flux must be developed is twice as great in *III* as in *I*, hence the total flux development by *I* will be twice as great as that developed by *III*.

Furthermore, the helix of *II*, Fig. 19, will develop more flux than will that of *I*, the ampere-turns being the same in each case, because the area of *II* is greater than that of *I*, hence the reluctance of *II* is less than that of *I*. The flux density—number of lines per square inch—in *II* will be the same as that in *I*, but there are more square inches in *II* than *I*, therefore there will be more lines developed in *II*.

To calculate the flux development by an air-core helix, the same fundamental principles which have been discussed are applied. As stated in the preceding paragraph, flux density varies at different locations within the air core of the helix, being twice as great at the center as at the ends. It logically follows that the magnetic gradient at these locations will be in proportion. At the center of the air-core helix:

(39) $H = M \div l$ (ampere-turns per inch length)

Therefore, since from equation (33) $H = B \div \mu$, at the center of the air-core helix $B = (M \times \mu) \div l$. Also, μ for air is 3.19 perms per inch cube. Therefore, the flux density *at the center of an air-core helix is:*

(40) $B = 3.19 \times M \div l = 319 \times I \times N \div l$ (lines per square inch)

Since the flux density at the ends is one-half as great as at the center, the flux density at the ends of an air-core helix may be computed from this formula:

(41) $B = 1.6 \times M \div l = 1.6 \times I \times N \div l$ (lines per square inch)

wherein, B = flux density, in lines of force per square inch, in the air core of a helix, M = magnetomotive force, in ampere-turns, of the helix; I = the current, in amperes, flowing in the helix; N = the number of turns in the helix; l = the length of the helix, in inches.

The above formulas give very accurate results for air-core helices or solenoids which are 100 times, or more, longer than their diameters, provided the turns are wound close together. However, they give approximate results for short solenoids or helices, even if the turns are spread apart. All magnetic circuit calculations give approximate results because of leakage. The application of the higher mathematics

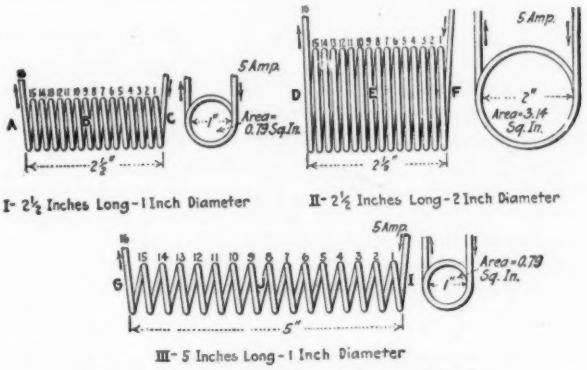


Fig. 19.—Several Forms and Sizes of Helix.

is necessary for the computation of the flux density produced by an air-core solenoid at locations other than the center and the ends of the core.

To obtain the total flux in an air-core helix at the center or at the ends, multiply the flux density at the given location, which may be computed with the above formulas, by the area in square inches of the air core of the helix. That is, $\phi = A \times B$.

Consider the following example. In Fig. 19 three different air-core helices are shown. Each has 16 turns and the current in each is 5 amperes. What is the flux density in the core, at the center and at the two ends, of each helix? What is the total flux ϕ in the core, at the center and at the ends, of each helix?

Solution for Helix I.—Substitute in formula (40), the flux density at the center is $B = (3.19 \times I \times N) \div l = (3.19 \times 5 \times 16) \div 2.5 = 255.2 \div 2.5 = 102.1$ lines per square inch. To compute the total flux at the center B of this helix, which has an area of 0.79 square inch: $\phi = A \times B = 0.79 \times 102.1 = 80.6$ lines. The flux density at ends A and C of the helix will be $B = (1.6 \times 5 \times 16) \div 2.5 = 51.1$ lines per square inch. Note that the flux density at the ends is just one-half of that at the center. The total flux at the ends A and C is $\phi = A \times B = 0.79 \times 51.1 = 40.3$ lines. This is, it will be noted, just one-half of the total flux at the center of the helix.

For Helix II.—This has the same number of ampere-turns but is of larger diameter. The flux density at the center is: $B = (3.19 \times 5 \times 16) \div 2.5 = 102.1$ lines per square inch, which is the same flux density as computed above for the helix *I*. But, now compute the total flux in the air core (which has an area of 3.14 square inches) at the center E; $\phi = A \times B = 3.14 \times 102.1 = 320$ lines = total flux at center.

Note that the larger the diameter or the area inside of the coil, the greater will be the total flux, even if the flux density is the same. In each of the ends, D and F, of *II*, the flux density will obviously be the same as that at the ends of *I*, namely 51.1 lines per square inch, but the total flux at the ends will be: $\phi = A \times B = 3.14 \times 51.1 = 160.5$ lines.

For Helix III.—This has the same number of ampere-turns as the other two, *I* and *II*, but is twice as long as *I*, and is one-half the diameter of *II*. The flux density at its center J will be: $B = (3.19 \times 5 \times$

16) ÷ 5 = 51.1 lines per square inch, which is just one-half the density at the center *B* of *I*, because the length of *III* is twice that of *I*. Now, the total flux at the center *J* of this helix, which has an area of 0.79 square inch, will be $\phi = A \times B = 0.79 \times 51.1 = 40.3$ lines. The flux density at the ends *G* and *I* will be: $B = (1.6 \times 5 \times 16) \div 5 = 25.5$ lines per square inch. This is just half the flux density at the center *J*. It follows that the total flux at the ends *G* and *I* will be: $\phi = A \times B = 0.79 \times 25.5 = 20.2$ lines.

Summary.—From a consideration of the above examples it is evident that (*a*) the total flux, and likewise the flux density, is different at different locations along its length in an air-core helix or solenoid, (*b*) the greater the diameter or core of a solenoid, the greater is the total flux that is developed—although the flux density developed by a given number of ampere-turns is always the same, regardless of its diameter, at a given position in the solenoid of this example.

Effect of Leakage in Magnetic Circuits.

The magnetic circuit of an air-core helix is not accurately defined because of the paths taken by the leakage lines. However, the total flux produced by the helix at its center and its ends can be readily computed as suggested, by applying the above equation. It can also be shown that the total reluctance, in rels, of the magnetic circuit of a long straight air-core helix is equal to *the length of the helix, in inches, ÷ the area of the core of the helix, in square inches.* In other words, if the total magnetomotive force of such a helix is divided by its reluctance, in rels, obtained as just described, the total flux produced, that threading the helix at its center, will be the result. All of this flux flows through the air core of the straight helix at its center but it spreads out so that at other locations than the center within the air core, there is less flux than the total amount developed. As has

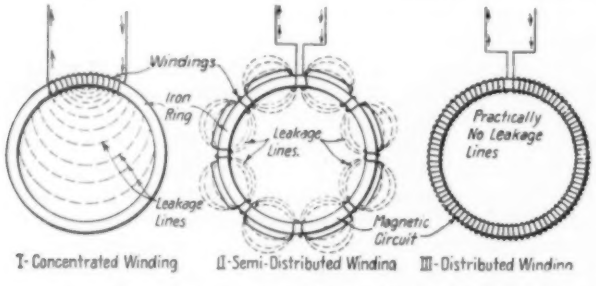


Fig. 20.—Leakage from a Magnetic Circuit Surrounded by Air.

been shown, the flux at the ends is but one-half the total developed. If, however, an air-core helix is bent into a circular form or toroid, practically all of the lines of force, developed by the ampere-turns, remain inside of the helix and then the path and the area of the air magnetic circuit are very definitely defined. Hence, the reluctance of a toroid magnetic circuit can be very accurately computed and the flux in the air core at any location around the core, that a certain number of ampere-turns will develop, can be easily calculated.

When the turns of a helix are wound around iron and are evenly distributed along the magnetic circuit, as for example, in Fig. 20, *III*, or on a closed iron magnetic circuit, even where there are but a few turns close together, or the turns are concentrated as in *I*, nearly all of the flux will follow the iron path because the surrounding air has much greater reluctance than the iron. In making magnetic-circuit calculations, it is usually first assumed that all of the flux stays in the iron. Then, corrections such as experience and experimental evidence have shown to be necessary, are made for leakage, if required. There will be considerably more leakage with the arrangement of *I* than with that of *III*, but for any ordinary practical problems the leakage in *I* might be disregarded.

[THE END.]

GENERAL METER CONFERENCE HELD AT DAYTON, O.

Committee of Ohio Electric Light Association Discusses Demand Meters.

The first 1917 general meter conference of the Ohio Electric Light Association was held at Dayton, O., in the Welfare Hall of the Dayton Power & Light Company on Friday, November 23.

The topic for the conference was "Demand Meters." In the morning session there were 41 central-station representatives present.

C. P. Garman, of the Dayton Power & Light Company, presented a report on "Demand Meter Practice," which report was based on the replies to a comprehensive list of questions which had been sent out to central-station metermen over the country. This report covered very thoroughly the practice of central stations in handling the subject of demand from a metering and operating standpoint.

Mr. Garman's report was followed by papers by Karl Bausman of Dayton Power & Light Company on "Line Inspections and Maintenance of Demand Meters" and by A. H. Bryant of the Cleveland Illuminating Company on "Laboratory Inspections and Testing of Demand Meters." Both of these papers brought out a number of very important considerations in connection with the handling of demand meters on the line and in the laboratory. The morning papers were followed by an intensive and constructive discussion.

At noon the session was adjourned for lunch at the Miami Hotel. A very interesting talk after lunch was delivered by L. C. Kettering, of Dayton, on the construction of the aeroplane and its relation to the war. Mr. Kettering is chairman of the Aeroplane Production Board of the United States Government and is one of America's foremost aviation engineers.

The afternoon session was called to order at 1:30 p. m. with an attendance of 66. This session was open to all.

Chester I. Hall, of the General Electric Company, read a paper on the "History and Development of Demand Meters," from the standpoint of the General Electric Company, and Wm. Bradshaw, of the Westinghouse Electric & Manufacturing Company, read a paper on the same subject from the standpoint of the Westinghouse Company. Both papers were well illustrated by lantern slides and brought out many new thoughts in connection with the metering of demand. These papers were followed by a general discusion up to time of adjournment.

A vote of thanks was extended to Messrs. Hall and Bradshaw for their kindness in presenting their papers at the meeting and also to the Dayton Power & Light Company for the kind and courteous manner in which they entertained the conference.

This was one of the most successful conferences which have been held by the Meter Committee. These conferences are steadily growing in interest.

Editorial Comment

Electrically Operated Ice Plants

IN THE development of the electrically operated ice plant central-station companies and electrical manufacturers have brought out a process, as they have in so many other instances, which is not only of very real advantage to themselves, but of immense benefit to the health and security of the communities served. The purity of raw-water ice is no longer questioned, and perhaps the day may come when it will have succeeded in completely ousting natural ice from distribution in localities other than those at sources of natural ice.

The consumption of ice per capita is increasing, and the proportion of ice made electrically is entering into keen and successful competition with natural ice. While electrically made ice has many advantages in its favor, which the public have been quick to appreciate and avail themselves of, the marketing of natural ice is suffering under a burden of adverse conditions over which it can never have any control. The ice fields are tending to gradually move further and further away from the markets in the endeavor to keep away from contamination of sewage and industrial wastes, while rising freight rates tend to exaggerate the distance and add to the cost of bringing it in. Each year is making it more difficult to find men for harvesting natural ice, because the work is hard, the cold often intense, comforts of the city usually lacking, and as labor becomes increasingly scarcer the difficulties of finding labor to go out for the ice assume greater magnitude. Moreover, ice is subject to loss due to shrinkage at harvesting, in storage and transit, while delays at congested railroad terminals during the warmer months add to the loss.

These are the things that are adding to the cost of marketing natural ice and detracting from ever-dwindling profits. But this is not all, for other influences are at work that are surely if slowly decreasing the demand for natural ice. The chief influence is not the purchase price of ice, but the American standard of living, the better appreciation of the value of care, in the maintenance of health. The safety movement is reaching into the home, the restaurant and hotel, and is being applied to the ice box. Pollution from streams and seepage cannot occur with clean, pure ice artificially made, whereas it may readily occur with ice that comes from far-distant and unknown places.

The use of ice will continue to increase because merchant and housewife alike now realize that with such high food values money spent on ice is an economical as well as a conservative measure. Ice is no longer a luxury, but a necessity; an economy, and not an extravagance.

The thrift idea, the nation-wide movement in the interests of conservation, the high economic and intrinsic value of foodstuffs, are all working for the electrically operated ice plant. Economic conditions, the safety movement, and the labor situation are cooperatively boosting the electrically operated plant and simultaneously driving out the primitive, old-time method of harvesting natural ice except for special conditions.

Central-station companies can gain immensely from the trend toward higher standards of living that aim for greater comfort, and more important still, the exercise of greater care in our mode of living. The need is there, and the electrically operated ice plant meets it. The electrically operated ice-making or cold-storage plant is a load that should be developed enthusiastically. It is a profitable load, twenty-four hour or off-peak service as conditions of ice demand and system loads determine. During the winter months the load is comparatively light, in the summer when the winter peak-load periods are absent it is at its heaviest, especially in northern climes. It is a load with a high load-factor, if flexibly designed, that constitutes a high energy consumption compared with the connected load.

The artificially made ice plant is a boon to the community served, for pure ice is a necessity for comfort, and health, and in the interests of food conservation. The electrically operated ice plant is now a boon to many central stations operating them. When making ice, "do it electrically."

Water-Power Development a War Need

IN HIS masterful war address before Congress on December 4, President Wilson said that it is imperatively necessary that the consideration of the full use of the water power of the country and also the consideration of the systematic and yet economical development of such of the natural resources of the country as are still under the control of the Federal Government should be resumed and affirmatively and constructively dealt with at the earliest possible moment.

We have pointed out on many occasions that the difficulties in securing supplies of coal, coming coincident with the enormous demand for supplies and for manufacturing facilities of all kinds, accentuate the need of developing all of the water power which it is possible to utilize, but much of the available water power of the country cannot be developed without enabling federal legislation which Congress has so far failed to enact.

Bills are now pending in Congress the passage of

which would place the requisite authority in the hands of the Departments of War and Interior, adequately protect the public interest and at the same time assure the early development of the water powers—if not in time for use during the war, certainly in time for the world-wide economic conflict which will follow it.

Two or three decades ago the usefulness of water powers was limited to industry upon the river banks. First came the adaptation of electricity as a power agent. Following closely behind improvements in the generating machinery came new efficiencies in transmission equipment, until now hydroelectric power is turning the wheels in factories and workshops over a radius of more than 200 miles from the water power generating it.

If Congress, in the enactment of constructive water-power legislation, had kept abreast of the engineer in the improvements in the generation and transmission of hydroelectric power, millions of additional horsepower would be available today, the pressure for priority fuel shipments would be substantially reduced and business generally would face its responsibilities for winning the war with an abundance rather than a shortage of mechanical power.

The President, by including this question in his message, has emphasized its importance and placed the matter squarely before Congress. The pressing need of suitable legislation is daily becoming more obvious and it will be interesting to see whether petty quarrels can much longer retard a development of national import.

War-Time Lighting

THE development of illumination has made vast and rapid strides of recent years. And yet never was it more necessary than today that ample illumination, correctly applied, be encouraged, nay, made compulsory, throughout the industrial world.

Mental and physical fatigue, upon which the health, the vision and the ability of the individual to work depend, are intimately related to adequate lighting, correctly applied and properly diffused.

Few indeed realize the expense of poor and inadequate lighting, and the dangers, the accidents and the waste of material and time for which it is answerable. It has been claimed that poor lighting is annually responsible for not less than 20,000 fatal accidents, and 125,000 accidents that bring suffering, disability and disablement and expense to the individual and high economic as well as financial loss to the nation. How, therefore, can the creed of safety be followed without adopting the policy of scientific lighting? It has been claimed that a million dollars' worth of time is wasted weekly, and even more now in these times of speeding up production and forced outputs because of insufficient and improper lighting; that $28,000,000 would not cover the annual waste of time and material lost because of inadequate illumination. And yet people talk of conservation of labor and materials, with not a word about illumination! If a complete estimate could be made of the relation between poor lighting and financial and economic losses and human suffering, the facts would be staggering. If the relation between the cost of adequate scientific lighting and its accomplishments in the way of saving of time and energy and betterment of living conditions and production were shown, one would be little less astounded. The one would be astounding for its vastness; the other hardly believable for its insignificance.

Perhaps there is no better investment than that spent for ample illumination correctly applied, whether in the interests of health, in the cause of safety, the speeding up of production or improved quality, or the conservation of vision and life and materials. And perhaps, too, there is no other investment that pays for itself in so short a time. Proper illumination does not mean high intensities applied indiscriminately. Glare and concentration must not be mistaken for ample lighting, for these interfere with illumination and thus interfere with the purpose sought. They are anathema to the conservation of vision and economical efficient lighting. Proper illumination means necessary light intensities properly diffused and scientifically applied. Correct illumination is always more economical than bad lighting, ignoring the ulterior effects, because light applied where it is wanted and in the amounts needed must always accomplish better results than lack of light or excessive light poorly placed. The best illumination is always the most economical.

Every dock that handles freight, every shipyard that builds ships, every factory that makes ammunition or guns or clothes, every shop, everywhere where industry hums and roars, where speeded production is the order of the day, needs the best illumination available if they are to do their work most efficiently and of best quality. Wherever industry reverberates, there scientific illumination should be found. If the work is for the war, adequate scientific illumination should be compulsory. If not, it is an advisable measure in meeting competition and safeguarding the product and the individual.

Correct illumination at this time is not a matter of choice. It is an absolute necessity, as necessary as is the conservation of labor and materials, for they are interrelated. A survey of lighting conditions could with advantage be taken up now by every utility company whether supplying electricity or gas. It is a war measure, for illumination has a basic influence upon production, national well-being, and health and safety. Electric lighting is almost unique and alone, because it has steadily and rapidly decreased in cost where almost everything else has soared upward. More and better lighting is made easier of accomplishment since it is cheaper now. And, moreover, it is a measure that is in the interests of all, and the utilities are not the least of these.

Week's Events

Economy Company Buys Arkless Fuse—Heating-Device Manufacturers Merge —Massachusetts Contractors Organize—New York Railways Get Fare Increase— Goodwin Plan Endorsed

ECONOMY BUYS "ARKLESS" FUSE.

Business of Detroit Fuse & Manufacturing Company Taken Over by Economy Company—Standard and Renewal Fuses to be Manufactured.

An announcement of peculiar interest to the electrical industry and to all users of fuses, is made in a letter addressed to the trade stating that the entire fuse business of the Detroit Fuse & Manufacturing Company, maker of the well known and long established line of "Arkless" inclosed fuses, has been purchased by Economy Fuse & Manufacturing Company, Chicago.

The transaction includes the conveyance of all merchandise, materials, machinery, tools, designs, patents, good will and unfilled orders. The physical assets of Detroit Fuse & Manufacturing Company, insofar as they pertained to the making of fuses, have been shipped to the Chicago plant of Economy Fuse & Manufacturing Company, where the manufacture of "Arkless" fuses will be continued, production being, as heretofore, under the label service of Underwriters' Laboratories, Incorporated. One organization will produce "Arkless" non-renewable fuses, "The fuse with the 100 per cent indicator," one of the oldest standard fuses on the market, and Economy renewable fuses, the pioneer fuse of the renewable field.

Arrangements made well in advance enable Economy Fuse & Manufacturing Company to take over the "Arkless" fuse business without interference with deliveries of either "Arkless" or "Economy" fuses.

It is to be well noted that the "Square D" line of inclosed safety switches remains the property of Detroit Fuse & Manufacturing Company, who will concentrate on its production and marketing.

IMPORTANT CONSOLIDATION OF HEATING-DEVICE MANUFACTURERS.

Hughes Electric Heating Company, Hotpoint Electric Heating Company and General Electric Heating Department Form New Company.

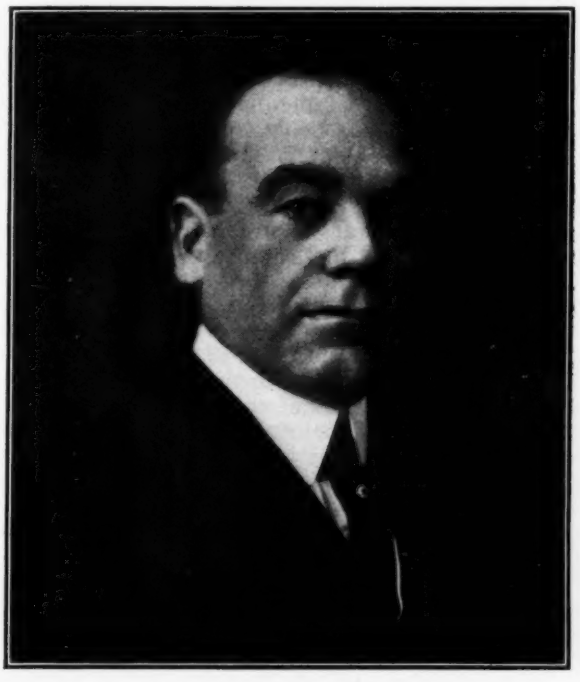
Incorporation is announced of the Edison Electric Appliance Company, Inc., under the laws of the state of New York. This company will take over as of January 1, 1918, the Hotpoint Electric Heating Company and the Hughes Electric Heating Company (with the exception of certain foreign rights, particularly the Canadian business of these companies), and the domestic or household heating-device business of the General Electric Company.

The industrial heating device and furnace business will not be transferred by the General Electric Company to the new company.

The new company will devote itself actively to the question of standardization of the various devices, which would lead to greatly improved commercial conditions in the distribution of these products by central stations, jobbers, dealers and other distributing agents.

The new company will operate three manufacturing plants:—the Hughes factory at Chicago and the two Hotpoint factories—one at Chicago and one at Ontario, California. The General Electric Company's heating device manufacture now carried on at Pittsfield will be removed to the Hotpoint and Hughes factories at Chicago. Commercial headquarters of the company will be at Chicago. The board will consist of the following:

Chairman—Willis H. Booth.
President—George A. Hughes.
Vice-president—A. K. Baylor.
E. H. Richardson.
A. F. Vaughan.
G. F. Morrison.
C. E. Patterson.
H. C. Houck.



George A. Hughes.

Mr. Hughes' election to the presidency of the newly formed Edison Electric Appliance Company, Inc., is a well deserved honor to a man who has done more than anyone else to popularize electric cooking. He established the Hughes Electric Heating Company only about six years ago and has seen it grow from a very modest shop into one of the largest institutions of its kind in the electrical industry. Mr. Hughes is the inventor of the electric range bearing his name.

W. H. Booth, P. H. Booth and E. H. Richardson are at present officers of the Hotpoint Company and Messrs. Hughes and Vaughan of the Hughes Company. P. H. Booth, now sales manager of the Hotpoint Company, will act as sales manager and vice-president of the new company. The complete factory, engineering and commercial forces of the Hotpoint and Hughes Companies will go over to the new company.

Certain of the commercial and engineering representatives of the General Electric Company's heating-device department will go with the new company. This list will include J. D. A. Cross, who has charge of General Electric Company's heating-device sales, and C. P. Randolph, engineer in charge of General Electric Company's heating-device production at Pittsfield, who will both be located at Chicago.

It is probable that the new company will continue to sell the three distinct lines of product: namely, the Hotpoint, Hughes and General Electric devices and ranges.

MASSACHUSETTS ELECTRICAL CONTRACTORS REORGANIZE.

Special Meeting Results in Adoption of New Constitution and Change of Name to Massachusetts State Association of Electrical Contractors and Dealers.

A reorganization of the Electrical Contractors' Association of Massachusetts, in accordance with the reorganization policy of the National Electrical Contractors' Association, was effected at a special meeting held at Worcester, Mass., on November 27. The meeting was called by President A. J. Hixon, of Boston, who explained at length the idea of the new constitution and the possibilities it provided for increased influence. Frank L. Barnes, of Boston, as chairman of the Membership Committee, presented the report of this committee, which suggested a new schedule of dues as follows: Firms doing an annual business of less than $8000, total dues $17, of which $12 goes to the state association and $5 to the national; for firms doing an annual business of various amounts between this and $500,000, the dues increase by definite amounts, so that for the larger firms the proportion of the state dues diminishes, for instance, for firms with business of $400,000 to $500,000 per year, the total dues are $156, of which $100 goes to the national association and $56 to the state association; for firms doing a business of over $500,000 annually the dues are 3/8 of 1/10 of one per cent, of which one-half goes to the state association and one-half to the national association.

It was decided to divide the state into six districts, for which there were elected the following representatives to the State Executive Committee: Berkshire District—H. W. Jones, of Lenox; Connecticut Valley District—A. J. Newall, of Holyoke; Worcester District—Frank Ham, of Worcester; Merrimac Valley District—H. W. Kimball, of Haverhill; Boston District—H. A. Holder, of Boston; Old Colony District—W. H. Doughty, of Fall River.

The vote on the adoption of the amended constitution was unanimous. James R. Strong made a very interesting explanatory address upon the Goodwin plan, after which the new State Executive Committee held a meeting and elected the following officers: State chairman, Alfred J. Hixon, Boston; secretary, J. E. Wilson, Boston; treasurer, Frank L. Barnes, Boston; state committeeman, W. K. Tuohey, Springfield.

SIX NEW YORK ELECTRIC RAILWAYS OBTAIN FARE INCREASE.

Favorable Action Now Expected on 20 Other Cases Now Before Commission.

The Public Service Commission of the Second District, New York, has granted an increase in fares to six out of the nine trolley companies whose petitions have been heard. The companies serve Northport, Amityville, Glen Cove, Sea Cliff and Huntington, L. I.; Hornell, Canisteo, Ithaca, East Ithaca, Newburg, Walden, Peekskill and Ossining.

The Hudson River & Eastern Traction Company, operating in Peekskill, is allowed to raise its fares to 7 cents. The other companies are allowed to raise the fare to 6 cents.

Three other companies have been heard on their petitions for increased fares—the Peekskill Lighting & Railroad Company, which operates about ten miles of track in and near Peekskill, N. Y.; the Putnam & Westchester Traction Company, a road of about three miles in and near Peekskill, N. Y.; the Glen Cove Railroad Company, which operates about three miles of track in and near Sea Cliff and Glen Cove and Hempstead Harbor, L. I.

The Commission decided the above cases after argument at length on these points raised by the opposition to the increased fares:

(1) That, as the old State railroad law limits fares to be charged on street cars within municipal limits to 5 cents, the Commission has no power to raise the rate.

(2) That franchises or municipal consents, limiting a fare to 5 cents constitute contracts, and the Commission has no power to raise the fare.

The Commission overrules these points and holds that it has the necessary rate-making power.

The increased rates of fare, the Commission stated, may be reduced if later on it be shown that they are no longer necessary.

More than 20 other companies have petitioned for increased fares, and it is expected these cases will now be rapidly disposed of. Each company has to make out a case on its own account.

REGULATIONS AFFECTING SIGN LIGHTING MODIFIED.

United States Fuel Administration Issue Statement Summarizing Provisions of Order.

The United States Fuel Administration, Washington, D. C., has issued a general order to state fuel administrations summarizing the main points of the order issued on November 9 relating to electric sign lighting. The main points of the communication are as follows:

First: The order provides that directional signs on retail stores may be illuminated from one-half hour after sunset until the regular closing time for transacting business, but not later than 11:00 p. m. Directional signs are signs over the door or extended over the sidewalk, which give the name and the nature of the business. Exterior advertising signs other than those of a directional character shall not be illuminated earlier than 7:45, and shall be extinguished at 11:00 p. m.

Second: Directional signs on theaters are the name of the theater and the name of the performance.

Such signs may be illuminated from one-half hour after sunset until one-half hour after the time scheduled for the commencement of the performance. The display advertising signs on theaters and places of assembly, however, may only operate from 7:45 to 11:00 p. m.

Third: In the case of motion-picture theaters with a continuous performance, directional signs may be illuminated from one-half hour after sunset until one-half hour after the beginning of the last performance. Display advertising on such theaters may only operate between 7:45 and 11:00 p. m.

Fourth: Directional signs on hotels may be operated from one-half hour after sunset until 11:00 p. m., but display advertising on hotels, either on the roof or on the front of the building, may only be illuminated from 7:45 to 11:00 p. m. This does not prohibit the use of porch or entrance lights on hotels as excepted in paragraph (d).

PROMINENT MANUFACTURER APPROVES THE GOODWIN PLAN.

Ratifies a Constructive Plan to Stabilize the Cost of Distributing Electrical Products.

J. Nelson Shreve, vice-president and treasurer of the Habirshaw Electric Cable Company and the Electric Cable Company, recently became very much interested in the campaign which W. L. Goodwin has been promoting, for a definition of the function of each factor in the distribution and sale of electrical materials and devices.

Mr. Shreve, in an interview, stated that while Mr. Goodwin's efforts were primarily intended to clarify the relations between manufacturers and jobbers and contractors, in his opinion a proper understanding of the function of both the jobber and contractor would serve as a demonstration of distribution methods which would deliver all such products to the ultimate purchaser, at the lowest possible cost.

Since the profits earned by the jobber and contractor are on goods in transit, it becomes necessary for each manufacturer to simplify the operation of distributing these goods, thereby stabilizing the differential for their service, in order to accomplish the economic result of final installation at the lowest cost consistent with good materials and service.

Such being his conception of the whole condition, Mr. Shreve has ratified Mr. Goodwin's policies and plans, as indicated by the following letter, addressed to Mr. Goodwin, and released with his approval, for publication to the whole electrical industry.

"As you know, we have been following your campaign of the electrical trade with a great deal of interest as it has fallen in so closely with what we had concluded to be the best method of following the trade that we could discover; in fact we are so much interested that we are going to take the liberty of telling you just how the thing looks from our point of view as manufacturers.

"To us the situation seems to be simply this: That there are two primary parties to every transaction—the manufacturer and the consumer. Jobbers or contractors, wholesalers and retailers are factors injected into the transaction solely for economic reasons to aid in distribution or physical supply, or to furnish the service of installation. Any compensation or differential allowed them is only for service rendered. Every transaction of the manufacturer terminates only when the goods are sold in a satisfactory manner to the consumer; that is to say, in the case of wiring devices, the obligation is not complete until they are installed and paid for by the owner.

"It is therefore essential for every manufacturing concern to consider their goods as carrying full responsibility until the final sale is made to the public and their approval acknowledged. It is then necessary to take the American public as a whole into consideration in order that they should be rendered service in connection with their electrical material and the proper allowance must be made in merchandising in order to assure every customer of the necessary service.

"This means that every manufacturer must conduct his manufacturing operations in such a way that the goods will arrive at the shipping door in the most economical unit or quantities possible to manufacture; and having settled this, he should then determine a reasonable cost for taking goods in such standard quantities and disbursing them into quantities ordinarily used in wholesale trade.

"He should then consider the cost of doing business with the retail trade and disbursing the wholesale quantity into retail quantities. He should also (if he elects to distribute to the wholesalers and retailers) provide in his selling schedule such differentials as will attract and encourage his wholesaler to buy from him in the most economical unit; and the retailer in turn to buy with the maximum of service to the manufacturer, dealer and consumer.

"I think that both you and I are agreed that there are only two reasons for discounts: one is quantity purchases and the other is service which it is possible to render in the course of sale to the prospective ultimate consumer.

"If, for example, a contractor in a certain territory equips a store, maintains a force of workmen and makes every effort to serve the public, this effort, on his part, to equip himself, and the investment of capital which it entails, should be compensated by an additional discount allowed him by the manufacturer.

"The same applies to the jobber. If he maintains an adequate stock of goods, good warehouse, competent selling force, differentiates between wholesale and retail business, and conducts his affairs along sound lines of credit and policy, thus assisting the manufacturer to distribute his goods, we believe he should be compensated for the function he fulfills.

"In the past, certain members of associations have labored under the erroneous impression as to the way to utilize the advantages obtainable by membership in such organizations. With some the impression prevails that membership in a trade association entitles the member to concessions not allowed the non-member. To anyone familiar with the real facts, it is evident that such is not the case. To the best of our knowledge, there is not an electrical manufacturer in this country who confines his distribution solely to the members of any organization.

"Unquestionably you will find the membership or organizations representing a large percentage of the total number of concerns used in distribution. This is due to the fact that most successful institutions fully appreciate the advantages of trade associations and have aligned themselves with these associations, so that it develops that practically all successful concerns are members of one or more associations.

"It is therefore evident that it is not economical to build up any artificial barriers in the channel of distribution. We feel sure that if this policy is thoroughly explained and understood, there will be none who

can criticize such a policy, either commercially or legally. I believe that if this policy were understood by everyone in the Federal Trade Commission at Washington, that you would not only be endorsed by them, but that your activities would be encouraged.

"I feel sure that the various objections I hear concerning the alleged illegality of your proposition are incorrect and only made by people who do not understand the principles you are advocating.

"I do not recall that you ever summed up in brief the primary thoughts of the effort you are making, and I am going to take the liberty of interpreting them as I see them.

"(1) Have every concern use such a system of cost accounting as will determine, so far as possible, the actual manufacturing and distributing cost of each separate article or unit that they manufacture or sell, without any regard of the cost of any other article or unit.

"(2) That the obsolete idea of averaging overhead and of requiring every article sold to carry the same rate of overhead for manufacturing, warehousing and selling should be superseded by the correct method of charging each article only with the cost applicable to that particular article for manufacturing, warehousing or selling.

"(3) That each article sold and every transaction entered into should produce a profit.

(4) That manufacturers or central stations are entitled to go into the jobbing business or the retail business, and that any contractor can likewise take up any function that he desires so long as any concern engaged primarily in manufacturing, or any central station indulging in any function outside that indicated by its name, should recognize all the factors of cost applying to any different branch of the trade in which they may embark; thus preventing the profit of their main business from being used to create destructive competition in another separate branch."

POSSIBILITIES OF MAGNETIC APPARATUS DESCRIBED.

Field of Clutches, Brakes, Pulleys and Lifting Magnets Discussed Before Chicago Electric Club-Jovian League.

That there is a rapidly increasing field for such magnetic appliances as clutches, brakes and lifting magnets and that the advantages of such equipment are becoming more generally known were points brought out in a paper by Horace G. Dawson, district manager, Cutler-Hammer Manufacturing Company, in a paper presented before the Electric Club-Jovian League of Chicago, on December 6. The evolution of present-day electromagnetic equipment was shown by means of diagrams and stereopticon views of typical installations were displayed.

Magnetic clutches and brakes are being extensively employed in industrial establishments, such as in rubber factories, stone quarries, paper mills, etc., where it is necessary to start machines under heavy load and likewise where it is often necessary to stop machines instantly in case of emergency. Magnetic pulleys are also finding wider application, particularly in sugar mills, cement mills, glue factories, etc., where separation of magnetic material from the non-magnetic must be a continuous process.

The various uses of lifting magnets were described and motion-pictures shown of magnets in operation, lifting pig iron, scrap iron and in the breaking of heavy scrap castings by means of a "skull cracker." One novel use of the lifting magnet pictured and described was in connection with recovering a cargo of sunken pig iron in the Tennessee River. An interesting feature of this case was that the insurance company paid the loss on the cargo, amounting to approximately $10,000, and later after an investigation of the possibilities, decided to reclaim the sunken iron by means of the lifting magnet. In the mean time the price of pig iron was steadily increasing so that when the cargo was recovered it was sold for $14,000, leaving the insurance company an appreciable profit after paying for the magnet and all costs of recovering the iron.

Texas Passes Law to Provide Against Stealing or Diversion of Electric Current.

H. S. Cooper, secretary of the Southwestern Electrical and Gas Association, 404 Slaughter Building, Dallas, Texas, is distributing copies of the new amended law against the stealing of electric current, gas and water, which law was recently passed by the Texas Legislature and becomes effective January 1, 1918.

(Sec. 1.) Whoever, intentionally, by any means or device, prevents electric current, water or gas from passing through any meter or meters belonging to a person, corporation, or company, engaged in the manufacture or sale of electricity, water or gas, for lighting, power or other purposes, furnished such person to register the current of electricity, water or gas, passing through meters, or intentionally prevents a meter from duly registering the quantity of electricity, water or gas supplied, or in any way, interferes with its proper action or just registration, or without the consent of such person, corporation or company, intentionally diverts any electric current from any wire, or water or gas from any pipe or pipes of such person, corporation or company, or otherwise intentionally uses, or causes to be used, without the consent of such person, corporation or company any electricity or gas manufactured, or water produced or distributed, by such person, corporation or company, or any person, corporation or company who retains possession of, or refuses to deliver, any meter or meters, lamp or lamps, or other appliances which may be, or may have been, loaned them by any person, corporation or company for the purpose of furnishing electricity, water or gas, through the same, with the intent to defraud such person, corporation or company, or, if any person, corporation or company engaged in the manufacture or sale of electricity, water, or gas for lighting, power or other purposes, shall knowingly misread any meter or overcharge any customer for such light, water or gas furnished, shall, for every such offense, be punished by a fine of not less than twenty-five dollars and not more than one hundred dollars.

(Sec. 2.) The presence at any time, on or about such meter or meters, wire or wires, pipe or pipes, of any device or pipes or wires resulting in the diversion of electric current, water or gas, as above defined or resulting in the prevention of the proper action or just registration of the meter or meters, as above set forth, shall constitute prima facie evidence of knowledge on the part of the person having custody and control of the room or place where such device or pipe or wires of the existence thereof and the effect thereof and shall further constitute prima facie evidence of intention on the part of such person to defraud and shall bring such person prima facie within the scope, meaning and penalties of this Act.

Commercial

Description of Prize-Winning Fan Windows—Attractive Literature of New York Edison—Other Commercial Activities

Winners Announced in Western Electric Company's Fan Merchandising Contest.

The entries in the Western Electric Company 1917 fan merchandising contest represented quality more than quantity. The Board of Judges consisting of O. H. Caldwell, editor *Electrical Merchandising;* E. L. Rogers, eastern manager ELECTRICAL REVIEW; Aglar Cook, advertising manager *Electrical Record;* George A. Wardlaw, editor *Electrical Engineering;* W. C. Peet of *National Electrical Contractor,* and H. W. Alexander, director of publicity for the Society for Electrical Development, had no easy time of it deciding first, second, third and fourth prizes, but after a prolonged discussion they were awarded as follows:

Window of New Orleans Railway & Light Company, Winner of First Prize.

First—New Orleans Railway & Light Company, New Orleans, La.

Second—Wilmington & Philadelphia Traction Company, Wilmington, Del.

Third—Sessions & Gray, Salt Lake City, Utah.

Fourth—The Denver Gas & Electric Light Company, Denver, Colo.

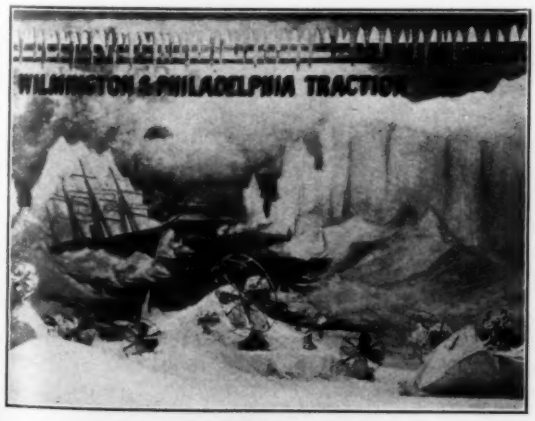
The prizes for the 1917 contest were increased over last year and it was a pity more contestants were not entered in the race, for surely a stake of $100 as the first award, $50 as the second, and two $10 prizes were worth more entries.

The New Orleans Railway & Light Company and the Wilmington & Philadelphia Traction Company divided the seven judges for a time, the former finally carrying off the first award, principally on account of the up-to-the-minute window display featuring fans in the role of soldiers storming old Summer's Heat Fort. The whole idea was original and well thought out. The Wilmington & Philadelphia Traction Company cinched the second money with its window display depicting the North Pole, its discovery and the fans whirling as a comparison. The Denver Gas & Electric Light Company held to an ocean scene with dolls and the proverbial cool beach and easily held fourth place, while the Session & Gray Company took the third prize without a window display, due principally to their merchandising ideas.

San Diego Company Adds 3700 Appliances to Its Lines in Ten Months.

During the first ten months of 1917 the electrical dealers of San Diego sold 3734 electrical appliances as follows:

1579 irons, 296 grills, 286 toasters, 251 radiators, 195 curling irons, 175 vibrators, 163 vacuum cleaners, 136 heating pads, 112 sewing-machine motors, 85 water heaters, 77 percolators, 55 ranges, 54 disk stoves, 38 washing machines, 17 soldering irons, 12 ovens, 9 chafing dishes, 9 cigar lighters, 1 ironing machine, 184 miscellaneous.

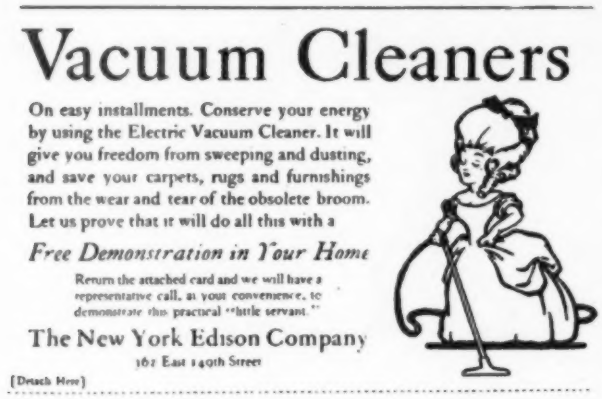


Window of Wilmington & Philadelphia Traction Company, Winner of Second Prize.

Window of Denver Gas & Electric Light Company, Winner of Fourth Prize.

Mailing Cards Bring Results for New York Edison Company.

That the use of return postal cards in appliance campaigns brings results is indicated by the experience of the New York Edison which has made consistent use of this mode of advertising. The accompanying


Vacuum Cleaners
On easy installments. Conserve your energy by using the Electric Vacuum Cleaner. It will give you freedom from sweeping and dusting, and save your carpets, rugs and furnishings from the wear and tear of the obsolete broom. Let us prove that it will do all this with a
Free Demonstration in Your Home
Return the attached card and we will have a representative call, at your convenience, to demonstrate this practical "little servant."
The New York Edison Company
362 East 149th Street
(Detach Here)
Iron out the wrinkles—
DON'T fuss and worry any longer over ironing day troubles. With an Electric Iron to save you steps and unnecessary fuel bills you will be free as never before from nuisance and expenditure
Try one for a week—Free
By mailing us the return card below you will receive an Electric Iron for a week's trial at our expense and without any obligation on your part
The New York Edison Company
362 East 149th Street
(Detach Here)

Two Postal Cards of New York Edison Company.

illustrations show two of a recent series of cards which have been particularly productive. A standard perforated card is used, one half being a self-addressed return card giving the name and address of the sender.

The New York Edison Company is a firm believer in attractive literature, designed to go to its customers, and its efforts in this direction have been taken as a model by other companies.

In addition to the series of return postal cards illustrated, the company has recently gotten out a series of attractive mailing cards, without the return feature, descriptive of the most popular domestic appliances such as toasters, irons, vacuum cleaners, percolators, heating pads, etc. Numerous booklets are also issued from time to time dealing with home economies, etc.

In all of the literature and advertising matter issued, the now-familiar Father Knickerbocker is featured, the slogan of the company being, "At your service."

Electrically Equipped Foundry at South Haven.—Marshall Castings Company, of Marshall, Mich., has established a new foundry of large capacity at South Haven, Mich. It is turning out castings for automobile and auto-truck parts, and other castings under special contracts. It uses electric power, buying the necessary current from the South Haven municipal plant. Installations thus far consist of two motors of 50-horsepower each; four of 40-horsepower each; and two of 5-horsepower.

Metropolitan Edison Company Asks for Rate Increase with Coal Clause.

The Metropolitan Edison Company of Reading, Pa., has filed with the Public Service Commission at Harrisburg, supplements to the company's schedule of rates, which, if approved will provide for an increase of 15 per cent in all classes of service with the exception of house lighting, the new rates to become effective on Tuesday, January 1, 1918.

Some days ago the company filed with the Public Service Commission other supplements to its tariff schedules, which provide for an increase to power customers only, to be regulated by the prevailing prices of coal and to become effective on December 16. This advance will automatically take care of the increased cost of coal over $3.50 per ton delivered.

The 15-per-cent advance provided for in the amended schedules just filed, is to help meet the increased cost of manufacturing power resulting from the increased cost of labor, materials, supplies and operating expenses generally.

It will be applied to all current furnished for power and commercial lighting in Reading and Lebanon, Pa., and their surrounding territories, residence lighting being the only class not affected.

Rhyme Book for Central-Station Customers Fills Need.

The A B C book is the name of a very unique and artistically colored illustrated rhyme book for children, on results obtained by doing things the electrical way, which has been prepared by John G. Learned of the Public Service Company of Northern Illinois and H. A. Seymour of the Commonwealth Edison Company, Chicago. This book is being offered to central-station companies for distribution to their residence customers, some companies offering it as a premium with appliance sales amounting to $2 or over, and it is also placed on sale at 25 cents a copy. The electrical suggestiveness of this book, in catchy rhyme, will not only affect the children's education profoundly, but the entire family will be interested and the results should be beneficial to central-station companies.

Advanced Power Rates of Seattle Utility Company.—An advance in power rates, granted by the Public Service Commission of Washington, to the Puget Sound Traction, Light & Power Company, Seattle, which took effect August 14, this year, applies only to new customers, according to H. J. Gille, sales manager of the company. Power rates for 100 horsepower or over are advanced from a minimum of ½ cent to 1 cent per kilowatt-hour. The minimum kilowatt-hour charge for 21 to 100 horsepower is advanced from 9/10 of a cent to 1⅛ cents, while for power ranging from 1 to 20 horsepower the new charge is 1¼ cents instead of 1 cent. No change is made in light rates.

Electric Ranges Popular in Montana.

The Kalispell (Mont.) Division of the Northern Idaho & Montana Power Company has sold three carloads of electric ranges since January 1. This class of business has been a factor in the increase of the company's output of electrical energy which for November 19 was the greatest in the history of the company.

Operating

Suggestions for Manhole Cleaning—Pre-Heating Furnace Air—Fuel Economy Notes—Illuminating Water-Column Glass—Pole Steps

MANHOLE CLEANING AND MAINTENANCE.

Importance of Periodic Inspection and Cleaning Shown—Practical Suggestions on Best Methods.

By M. S. MONTGOMERY.

The periodic inspection and cleaning of manholes of underground systems is an important if unpleasant practice. All manholes require cleaning out from time to time as they tend to become filled with filth of all sorts and if not cleaned become foul from the sewage and slime that seeps into them through the ducts and elsewhere, from the road surface and surrounding soil. The season is already here when rains and mud find their way into the manholes, in addition to that which has gradually accumulated during the dry summer months.

The frequency with which manholes require cleaning out depends upon local conditions. Sometimes once a year suffices, and then again in downtown districts where the traffic is dense and the roads are flushed daily large quantities of silt find their way into the manholes, necessitating more frequent removal therefore. The frequency of cleaning depends upon local condition, traffic, form of road surface, conditions of water and sewer pipes in vicinity, formation of surrounding soil, conduit construction and effectiveness of manhole drainage. The present time is an opportune one for cleaning manholes, however, for several reasons. If removed now sediment cannot freeze up and block drains, thus preventing the escape of melting snow, etc. Moreover, the seepage removed has less odor now than it had in warmer weather of a few weeks ago. And then again a clean manhole will assist very materially the location and repair of cable faults during the next few months, whereas one filled with filth always hinders. The cleaning can now be done more conveniently than a few months ago in the majority of cases, because the normal extensions of new cable to care for load increases, etc., are mostly over for the season, and thus the laborers are now less busy than during the summer months. Put them to work cleaning and inspecting the manholes, in their spare time.

The gang cleaning manholes should consist of two sections; the one utilizes men working in pairs, one man collecting the dirt in the manhole and filling buckets while his partner hauls them up and dumps their contents at the curb stone. The second section comprises a dump cart and driver, who collects the piles of dirt along the curb stone and carts it away. This work can be carried on during the day in outlying districts but in the downtown sections must be done either at night or on Sundays. The man down the manhole or the foreman in charge should be experienced in matters pertaining to manhole and underground construction. Every manhole cleaned should be inspected also. Defective cement covering of sheaths, drooping cables and sagging ducts, cracked covers, etc., should be reported. Excessive odors of illuminating gas and water leaks likewise should receive attention for the former create a hazard while the latter may cause sinking of the duct line. The coming of cold weather may cause excessive manhole and cable temperatures due to the close proximity of steam heating pipes, with deteriorated insulation on them. These things and many more an observant man will notice and report.

Manhole covers are invariably equipped with vents or holes, cast or drilled in them. These openings have a number of purposes. Firstly, they serve as ventilators to permit the hot air to escape and cold air to enter, thus constituting a system of natural draft, which not only assists the operating of the cables but makes the manholes less objectionable for a man to enter. The holes allow surface moisture and mud to ooze through the cover into the manhole, to drain away, instead of covering the manhole and making it difficult to find. The holes also offer a very convenient means of opening the cover with a pinch bar. But the chief purpose of the vents or holes is to permit the escape of gases such as often form in the manhole, and more especially such as occur when a cable breaks down and ignites illuminating gas or due to the heat of the arc. With high internal pressures in the manhole and no outlet the covers sometimes blow off, whereas with vents that are free and open the cover remains in place. Authentic cases exist where a cover with vents frozen has been blown up in the air, to fall upon passers-by. With the coming of cold weather it is important to keep the holes in manhole covers open. The men cleaning out the manholes should clean the under side of the covers at the same time that they open each individual hole. It is the dirt on the inside that thickens and forms a thick, strong covering of frozen mud over the hole, the dirt from the outside making matters worse. If the interior of the cover is cleaned, it is a simple matter during the winter to keep the holes open by simply pushing a stick through them from the outside.

Cable repairs are at best difficult to make as well as costly. The manhole is an unpleasant place to work. The cleaner they are the better the job the cable splicer will do. Where a new underground cable is to be pulled it is well worth while to have the manhole cleaners go ahead a day or so in advance, cleaning out the manholes where the cable is to pass through.

Seasonal cleaning and inspection of manholes is as important as it is unpleasant. Fewer troubles of all sorts develop in manholes that are maintained clean and dry and well ventilated than in those that are neglected, because troubles can be seen as they develop and before they have developed. Men work better and faster in a clean manhole, and much depends upon their work in these days of underground transmission and distribution.

PRE-HEATING FURNACE AIR.

Furnace Temperatures Increased by Degree of Pre-Heating—Clinkering Troubles, However, May Occur.

By Lionel Linnell.

The pre-heating of air before passing it into the fuel bed has long since suggested itself as a means of increasing the temperature of the fire. It actually accomplishes this, the increase of temperature of the fire being practically that due to the increase of air temperature due to pre-heating. The warmed air from turbogenerators is pre-heated to such a small extent and the quantity of air furnished from this source is so small compared with the total amount of air required by the fuel beds that the saving due to the use of this pre-heated air must at best be very small indeed. While this is true, there is another aspect of the case. Instead of merely raising the air temperature 60 degrees or so it is quite a different matter when the increase is 200, or better still 300 degrees, as an increase of this magnitude is worth while.

To obtain 200 or more degrees rise of air temperature it is necessary to install the requisite heat-absorbing apparatus. The usual place for this is in the stack, where the heat otherwise wasted by escaping up the stack can be utilized. The apparatus used is similar and almost identical to the economizer, the chief difference and modifications being due the fact that the one heats air for the furnace, the other water under pressure for the boiler. It might be thought that it mattered little whether air or water were used to recover heat that would otherwise be wasted. However, in practice it will be found that water can be more easily handled and controlled because of less bulk and ability to prevent leaks—a matter of great difficulty with air. Moreover, by using water less loss of heat occurs between heater and boiler than is the case between heater and fire when air is pre-heated.

There is another phase of the matter apart from those of whether it is worthwhile pre-heating the air or whether it is better to pre-heat the water instead of the air, namely the performance of the coal under pre-heated air conditions. Some coals clinker, whereas other coals are free from clinker troubles. Clinker is a function of the constituents of the coal and the temperature. Clinker is caused by the fusion of the ash, and this depends upon the temperature and the contents of the ash. Just what are the constituents or the constituent in the ash chiefly responsible for clinkering is not as yet definitely decided upon, but it is probably sulphur in the form of pyrites. Clinker occurs only when the temperature attained by the fire is at or above that required to melt the ash. A coal that burns satisfactorily at 2300 degrees may cause clinker trouble when the temperature is increased to, say, 2600 degrees, as might be the case where the air is pre-heated 300 degrees with a fire usually operating at 2300 degrees.

The coals that are the most expensive are the coals with low ash content and whose ash fuses at the higher temperatures. These coals are not only of higher price because of their better burning properties, but are not nearly so generously distributed throughout the country as are the lower grades of coals, with higher ash content and lower fusing temperatures. Many coals are burnt very close to and many actually above the clinkering temperature. This means that a coal which performed with but slight clinker trouble without pre-heated air supply might give trouble when pre-heating was adopted.

Clinker is objectionable under any and all circumstances. It increases the difficulty of disposal, because the clinker forms large masses that are not readily handled. The amount of carbon carried into the ash-pit is increased. The clinker attaches itself to the grates and clogs up the air passages and interferes with the performance of the fire. It attacks the furnace chamber walls and may act as a flux for the firebrick, whilst the use of rods and clinker cutters by the firemen is frequently the cause of rapid setting deterioration.

The sum total of these considerations is that pre-heating the air supplied to the fuel bed should not be undertaken without due consideration as to the characteristics of the coal, a close analysis of the actual saving due to the higher fire temperature, the ability of the firebrick and furnace chamber to stand the higher temperature and the cost of labor, decreased grate-bar life, etc. As the utilization of the heat in the flue gases can be accomplished without all these complications by heating the water instead of air, and with higher efficiency, it would appear worth while pre-heating water instead of air.

SUGGESTIONS FOR OBTAINING FUEL ECONOMY.

Doherty Organization Compiles List of 10 Hints for Guidance of Station Operators.

Henry L. Doherty & Company has compiled a list of 10 suggestions for effecting coal savings which is being sent to each of the plants under its management. In calling attention to the need of economy, the statement is made that "It would probably not be a misstatement to say that it is possible with practically no additional expenditure, to make a saving of 10 per cent in coal consumed in every one of the Doherty plants. Fuel economy, like war, is a matter of united effort and determination."

Following are some suggestions as to how this saving might be made:

(1) Watch conditions in the boiler room as that is usually the place where the biggest opportunities to make fuel savings occur.

(2) Keep the boilers in fit condition by thorough systematic inspection, cleaning and repairing. A boiler should never be put back in the line after being down for a cleaning or repairs until it has been completely inspected and all of the defects remedied. The inspection should be thorough and rigid and should cover not only the internal and external surfaces of the boiler, but the baffles, settings, piping, valves and all appurtenances.

(3) Keep the soot blown from the tubes daily. A good mechanical soot blower will do the work thoroughly and economically but is not absolutely necessary. The hand steam lance, if regularly and systematically used, will do the work nearly as well.

(4) Keep hand-fired grates or automatic stokers in a good state of repair else they not only cannot be operated most economically, but very easily become extremely wasteful. Thorough inspection and repairs are absolutely necessary if economical stoker operation is to be obtained.

(5) Assist the fireman to get proper combustion and boiler operation by (a) analyzing the flue gases; (b) by determining the percentage of combustible in the ash and; (c) by analyzing the fuel. Every plant should have a three-pipette Orsat apparatus and it

should be ready for use 365 days a year. A laboratory is provided at St. Joseph, Mo., for analyzing coal and refuse. There is, therefore, no reason why every plant should not be checked up in these points.

(6) Study the drafts and flue temperatures in the boilers and know that the baffles, bridge wall, dampers, etc., are properly designed and maintained.

(7) Keep no more boilers "hot" than are absolutely necessary to carry the load during the peak, and make sure that the most efficient method of banking is being used during off-peak periods.

(8) Keep the steam leaks about the plant down to a minimum and give special attention to small steam valves to keep them tight. See also that the steam traps and drip systems are in proper condition.

(9) Make sure that the exhaust steam from the auxiliaries is being used to heat the feed water in the most efficient manner. See that (a) there is no free exhaust not going to the heater; (b) that there is no steam exhaust from the heater with a water temperature of less than 210 degrees; if so investigate thoroughly; (c) that there is not an unnecessary amount of hot water overflow from the heater; (d) that the oil separator is properly piped up.

(10) Last but not least, do not overlook plant cleanliness. There is an old saying that, "Cleanliness is next to Godliness," but it is usually the forerunner of power plant economy. A slovenly and illkept plant is almost without exception an inefficient one.

Kink for Illuminating Water-Column Glass.

By H. K. Hutton.

An important detail in every boiler room is close attention to the water level of each boiler. In many cases, due to the poor illumination of the water column, difficulties have arisen from not maintaining the water level where it should be. The actual position of the water in the column is very hard to determine when the usual method of lighting is used, because the reflection of light from the glass obliterates the water line. When the glass tube breaks it very commonly results in the breakage of the lamp and this causes no little trouble in the boiler room.

I have found that excellent results may be obtained by placing a strip of white-anemeld metal about 4 by 20 inches in dimensions, three inches to

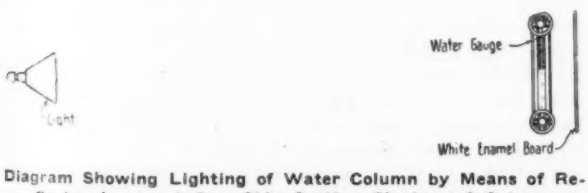


Diagram Showing Lighting of Water Column by Means of Reflector Lamp at One Side Casting Shadow of Column on Enameled Strip on Other Side.

one side of the column. On the other side of the glass and about six feet away from it, place a strong light from a lamp and concentrating reflector directed on the enameled strip in such a way that a well defined shadow is made on strip of the glass tube. On account of the high refraction on the part of the tube filled by water the shadow will be black above the water level and very much lighter below. Should the glass tube break the lamp would not be broken. This method of illumination at all times gives a positive location of the water in the boiler.

Safety Considerations Make Elimination of Pole Steps Desirable.

By H. E. Wagner.

Almost from the time when poles were first used for carrying electrical conductors steps have been used to facilitate climbing the pole. The result is that today the pole step is looked upon as an integral part of the pole, and a pole set without steps is the exception. However, there is a tendency in some quarters to do away with the pole step, because it is looked upon sometimes as adding to the hazards of linework. Apart from the aspect of increased safety, the movement toward economy and conservation of materials at this time makes the elimination of everything possible worth consideration. The pros and cons as to the pole step are therefore of particular interest at this time.

There are two aspects of the case for and against the pole step. One is necessity or convenience; the other safety.

The reasons advanced by those advocating the pole step are that it is a convenience and saves time in all cases where a pole is to be climbed, but especially in times of emergency such as fires, accidents, etc., and when a lineman is unequipped with climbing irons and must hastily climb a pole to pull potheads and handle primary cutouts. The use of steps, by eliminating the need for the use of climbing irons, also results in prolonged pole life, as the holes that occur in poles from the spikes of the irons shorten life by allowing the ingress of water and moisture to hasten rot, make the pole soft and rotten and make the use of climbing irons dangerous. The pole step is also of advantage in intensely cold weather because the frozen wood is slippery and hard, and climbing irons must be used very carefully unless accidents are to happen.

The disadvantages of the pole step usually advanced by its opponents are that the step is always a danger, and should a man fall or slip the sharp protruding step below may cause serious and even fatal injury; with ice and sleet steps are slippery to both the hand and foot; that a lineman with climbing irons on never uses the steps, hence they are not needed.

The consensus of opinion amongst linemen doing power work is that they would on the whole prefer pole steps removed, on the basis of increased safety, on all poles carrying a higher voltage than about 2400 volts, and even on 2400-volt poles except those upon which primary cutouts and disconnective type of potheads are used.

Where pole steps are already installed it is best to leave them in. Pulling them out is troublesome and almost always leaves a large hole which accelerates deterioration of the pole and makes the use of climbing irons dangerous. Pole steps should never be sawn off flush with the pole as this also may cause accidents with the climbing irons.

Electrically Heated Beds Save Wounded at the Front.—The present war is producing many improved therapeutic and surgical methods that have accounted for saving the lives of thousands of wounded soldiers. Mention has recently been made in English papers of the use of electrically heated beds for men who are so desperately wounded that they were almost on the verge of death. Numerous such cases have been revived in this manner. Electric heating elements are woven into the mattress and blankets of special hospital beds.

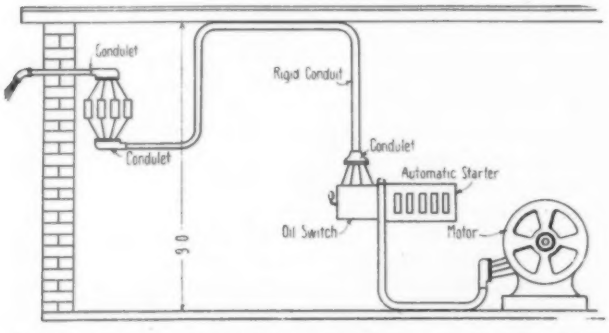
Construction

Rules for High-Tension Inside Wiring—Terminal Clips Facilitate Testing—Other Kinks—Among the Contractors

INSTALLATION OF INSIDE HIGH-TENSION WIRING AND MOTORS.

Rules Covering Buildings Other Than Central or Substations Issued by Louisiana Fire Prevention Bureau.

The war has greatly accelerated the electrification of industrial plants and in the case of the larger ones resulted in the installation of many high-tension motors, voltages in excess of 550 being used for large motors chiefly for economy. Where such high voltages are brought into buildings that are not central generating stations or substations continually in charge of competent operating electricians, there is of course special hazard both to life and property due to the possibility of errors being made by some nonelectrical men that may have access to the premises as is more or less commonly true in industrial plants. To minimize the likelihood of such troubles special regulations covering these installations have been issued by some electrical inspection organizations, notably the Louisiana Fire Prevention Bureau, New Orleans, La., which through its Electrical Department, of which R. P. Strong is chief electrical inspector, has drafted the rules and recommendations given below.



Installation for a 2300-Volt Induction Motor That Is Subject to Criticism.

An example of high-tension motor wiring coming under these rules was included in Question No. 352, which was answered and commented on by various members of the Executive Committee of the National Association of Electrical Inspectors on page 990 of the December 8 issue of the ELECTRICAL REVIEW. As shown in the accompanying illustration, the wiring was for a 2300-volt induction motor in a remodeled engine room; it was all done in conduit except for short exposed lengths of wire at the service fuses, near the oil switch and the motor. This very feature is one of those pointed out as being poor practice in the Louisiana rules given in the following:

LOUISIANA HIGH-TENSION RULES AND RECOMMENDATIONS.

General Requirements.—Interior wiring and motors operating at a potential between 550 and 3500 volts shall be installed to comply strictly with the National Electrical Code requirements and more particularly with those requirements of Rule 8 which relate to high-tension motors. The following suggestions are not to be construed as in conflict with any of the Code requirements, but are intended to describe methods of construction which will meet fully the spirit as well as the letter of the Code rules. To adequately safeguard interior high-tension installations and reduce to the minimum the liability of personal injury, there are three important general requirements to be observed:

1st. There must be no exposed live parts connected with the high-tension circuit.

2nd. Wires or conductors forming part of or connected to the high-tension circuit, no matter how well insulated, must be in metal conduit or completely inclosed in grounded metal shields.

3rd. The arrangement of all high-tension apparatus and wiring must be such that ample working spaces will be provided for persons in charge to safely operate, maintain and repair any portion thereof; where required, suitable guards or barriers must be provided, and permanent signs installed bearing the words "DANGER—HIGH VOLTAGE."

Note.—The wires of extra-high-potential systems, operating at a potential of over 2500 volts, must not be brought into or over buildings, except power stations and substations.

Wiring.—The high-tension wiring must be done with approved multiple-conductor metal-sheathed (lead-covered) cable in approved unlined metal conduit firmly secured in place. The conduit must be installed according to the rules for interior conduits and additional precaution must be taken at outlets, or where the several conductors leave the metal sheath of the cable, so that the conductors may be thoroughly protected from moisture and mechanical injury. The conduit must be substantially bonded to the metal casings of all fittings and apparatus connected to the inside high-potential circuit, and the metal of the conduit, and the casings of all fittings and apparatus must be permanently and effectively grounded. This includes the metal frame of the motor.

It is highly important that the grounded metal should be absolutely continuous and surround all apparatus and all of the wiring, including all splices and taps and all connections of wires to apparatus. This requires that conduit shall enter and be secured to the metal shields or casings surrounding the apparatus, or to suitable terminal boxes screwed or bolted to the casings.

Do not terminate the conduit at or close to the apparatus and bridge the gap with open wires—even if separated and protected with flexible tubing. At the motor terminals, and where the apparatus is not designed to permit the conduit being brought directly into the casing, it will ordinarily be necessary to terminate the conduit in a specially designed junction box arranged to serve also as the equivalent of a pothead.

This box should be designed with a removable cover, and with an opening in the back to fit over the terminal block or the bushings through which the wires are brought through the motor frame or the casing of the apparatus and the box should be secured by machine screws or bolts to the motor frame or to the casing. The box should be large enough to allow the splices after they have been thoroughly insulated to be well separated from one another and from the metal of the box. After the cover of the box is in place the box should be poured full of a suitable insulating compound which will form a seal around the point where the conductors leave the cable sheath, and will keep the splices separated and protected from moisture and mechanical injury.

In the case of a belted motor which must be adjustable to some extent for belt tightening, a short portion of the conduit may be flexible steel conduit to provide for the necessary movement of the motor on its base frame.

Switchboard.—The foregoing requirements as to complete inclosure of all the high-tension wiring and apparatus need not be considered as applying to a standard switchboard and the apparatus mounted thereon, when such switchboard is in a fireproof room or compartment and under expert supervision. In all cases, however, live parts of the high-tension circuit must be suitably covered, and the back of the switchboard made inaccessible to unauthorized persons.

Service.—High-potential service wires should preferably enter the building underground, but in all cases the service conduit must pass directly into the cabinet or inclosure containing the automatic cutouts (fuses, circuit-breakers or automatic oil-break switch, as the case may be) placed immediately at the point where the conduit enters the building and the service conduit must not at any point be in contact with combustible material. The service conduit for aerial service must project at least six feet from the building and its outer end secured to the pole, so that under no circumstances will any exposed high-tension wire be attached to the wall of the building, or be within reach of persons in the building or be likely to become dangerous to workmen, firemen, or others. Where overhead wires enter the service conduit, a pothead should be employed or the equivalent devised by using an approved service head filled with compound and provided with heavy porcelain tubes to separately bush each wire into the sealed service head. These tubes should be placed so that the wires will be well separated where entering, but tubes should not be long enough to be easily broken off. If deemed necessary by the inspection department, suitable petticoat insulators must be placed as near as required to the service head so that wires may be fastened to them and prevent any probability of strain on the service tubes. Immediately before entering the service conduit, the service wires should be provided with primary fuses of approved type and be protected by approved lightning arresters.

Conclusion.—In the above recommendations the words "standard" or "approved" refer to materials or devices approved and listed by Underwriters' Laboratories, Inc., and all wires or cables must be from coils having labels attached evidencing such approval. In all details of construction, whether mentioned or not in the foregoing, the work is to be executed in a substantial and workmanlike manner, strictly conforming to the National Electrical Code rules, and especial care is to be taken to provide conductors of ample size to accommodate the starting current of each motor, with the wires protected by automatic cutouts within the allowable carrying capacity of such wires as provided by the Code. Full details of the proposed installation should be submitted to this Bureau before work is begun, and the work should be done subject to inspection and written approval of this Bureau.

Use of Terminal Clips to Facilitate Testing.

By Robert Oster.

The operating electrician is frequently required to make tests where it is necessary to have convenient means for connecting the wires to the test instruments. In other work, usually of a temporary character, it is also often necessary that wires may be connected and disconnected frequently. I have found that it is most desirable for this purpose to use a connector that will save time usually lost in splicing or in twisting the ends of wires together. The ordinary shop testing is with comparatively small currents and on wires of No. 12 or 14 or smaller sizes. A good plan is to remove the special terminal clips supplied with certain types of dry cells, using old discarded batteries. These are of the Fahnestock type and it is best to use those from the carbon; those on the zinc can also be used but the clips on the carbon are drilled and bolted and are therefore much simpler to use than those which are soldered on. Secure one of the clips to each test wire by carefully wrapping the wire around the bolt through the clip and tightening it. This way of attaching I have found better than to solder the wires to the clip, because wires will break off near the point of soldering, after the clips have been used a short time. Wires from the circuit or article being tested can be quickly secured to the clips in this manner. By bolting or otherwise fastening two clips to the test device or instrument being used, so that the wires can be quickly connected thereto, a great many splices may be obviated and much better connection obtained than if the ordinary method of splicing had been used.

Improving Electric-Range Connections.

By Maurice J. Moriarty.

Some of the electric-range manufacturers do not provide for a satisfactory connection from the house mains to the range leads. The wires are brought out at a point in the rear of the range. The wiremen has to pipe up to a point as near the range wires as possible and then make an open-wiring connection to the range wires. This method does not make the neatest job as it allows open wiring where wires should be fully protected. I plan on using one of the many standard outlet boxes to suit the job at hand. This box I bolt to the back of the range and carry the stove leads into it. The house mains can be piped into the box and all connections can be made in the box, thus making a concealed job throughout.

Soldering-Iron Support.

A reader suggests a simple support bent from old bare stiff wire to shape like letter M but with smaller top notch and cross bends for feet so that from side it looks like an inverted T. On this he rests hot iron end when working on bench or floor to keep it clean and prevent it from igniting shavings or the board surface itself.

AMONG THE CONTRACTORS

The firm of J. F. Buchanan, 1719 Chestnut Street, Philadelphia, Pa., is wiring a $75,000 dormitory for the City of Philadelphia.

A new church building costing $40,000 being built at Rosemont, Pa., is to be wired by the contracting firm of N. P. Petchen, Wayne, Pa.

G. L. Craig & Co., Ferguson Building, Newcastle, Pa., have been awarded the contract for electrical work in a new $50,000 high school in that city.

The new chapel of Westminster College at Fulton, Mo., is to be wired by the Modern Electric Supply Company, of that city. About $2,150 is involved in this contract.

Hartmeyer Brothers, 907 Franklin Avenue, Wilkinsburg, Pa., have been awarded the contract for electrical work in a $35,000 residence being built in that community.

The Avery-Loeb Electric Company, 114 North Third Street, Columbus, Ohio, has under way the wiring of a $10,000 garage at 539 East Long Street in that city, owned by C. C. Williams.

The Beck Electrical Construction Company, Plymouth building, Minneapolis, Minn., has the contract for wiring 678 outlets in the new packing plant of the Northern Packing Company, Grand Forks, N. D.

The contracting firm of William Corrao, Syndicate Trust building, St. Louis, Mo., has been awarded the contract for the electrical work in a $150,000 addition to the plant of the Federal Rubber Company at Cudahy, Wis.

The Hatfield Electric Company, Indianapolis, Ind., has the contract for electrical work in a $90,000 office, sales, display and warehouse building being erected at Norwood Avenue and South Delaware Street in that city.

The Berg-Clark Electric Company, 10207 Euclid Avenue, Cleveland, Ohio, has received the contract for electrical work in two residences being erected on Washington Boulevard, Cleveland Heights, for the J. J. Rauschor Company, Garfield Building, Cleveland.

A large refrigerating plant being erected at Passaic, N. J., for Armour & Company, packers, is being completely wired and electrically equipped by the National Electric Company of that city. A total of 250 horsepower in motors and about 460 outlets are being installed.

The Y. M. C. A. building at Charlestown, Mass., is being completely wired by the M. B. Foster Electric Company, 514 Atlantic Avenue, Boston, Mass. The contract amounts to about $5000 and includes the wiring of about 500 outlets, installation of fixtures, telephone, clock and bell systems.

The Joseph L. Skeldon Engineering Company, Toledo, Ohio, is putting through a contract to furnish and install equipment for a pumping plant for the New York Central Railroad at Nottingham, a suburb of Cleveland. Plans require the installation of two Worthington centrifugal pumps, each of 3500 gallons per minute, and each direct-connected to a 200-horsepower motor. Water is to be taken from the lake, against a suction head of 8 feet and a discharge head of 139 feet. The water is to be measured by Venturi meters. The contract price is close to $19,000.

Pacific Fire Extinguisher Company, 507 Montgomery Street, San Francisco, Cal., has the contract for electric wiring in a $200,000 store and office building being erected at Fresno, Cal., for Frank Short. The electrical work amounts to $3500. It is planned at some future time to add six additional stories to the two now being erected.

The new Emergency Hospital being erected by the United States Navy at Chelsea, Mass., is being completely wired by the Columbia Electric Engineering Company, 309 Washington Street, Boston, Mass. The hospital consists of a group of 40 buildings connected by about 2000 feet of covered walks. The electrical work includes wiring for lighting all buildings and connecting walks, numerous electric heaters in the hospital wards and operating rooms, several motors, etc. All the work, material and fittings are of the highest grade and yet must be installed within a period of 75 days.

Washtenaw Electric Shop, Ann Arbor, Mich., installed battery-charging facilities a few months ago, and is making a special effort in advertising this service and reaching out for this line of business. It is estimated there are 2500 automobiles which might be served at this plant, and a vigorous campaign of advertising is being carried on. This concern has completed the installation of a number of alternating-current motors in the new foundry of the Ann Arbor Machine Company. Calvert M. Wardwell, president and manager of the Washtenaw Electric Shop, says he is getting good results from liberal local newspaper advertising, especially as to the sale of appliances.

John J. Schuitema, of the Schuitema Electric Company, Muskegon, Mich., is installing two Allis-Chalmers motors of 50 horsepower each in the pumping station of Muskegon Heights. These motors were sold by C. R. Dillman, who is in charge of motor sales of the Consumers' Power Company, Muskegon, which company will supply the service for the motors, as it is and has been for many years supplying service to the old pumping station, where there are three General Electric motors operating—two of 50 horsepower and one 35 horsepower. The new motors are being direct-connected to two centrifugal pumps, by which water from wells will be forced into the mains.

Fowler Electrical Supply Company, Toledo, Ohio, is beginning work on a contract for all electrical equipment required for a bascule type of bridge at Norfolk, Va. This comprises four 15-horsepower motors for bridge operating equipment; one lock motor of 5 horsepower; two 3-horsepower motors for gate control. The switchboards will provide for automatic limit switches and operating flashlight signals. The Fowler company is also engaged on a conduit wiring contract for the Dolomite Products Company, Tiffin, Ohio. This involves the connecting up of motors of the combined capacity of about 1000 horsepower with the transformers of Ohio Light & Power Company by which current is to be supplied. The motors will be controlled through several distributing panels. The Dolomite Products Company is to operate crushers, screens and rotary kilns in the preparation of a product used for furnace lining in steel plants. Hettrick Brothers, Toledo, Ohio, have erected a large building for their new tent and awning factory in which motors amounting to about 500 horsepower will be installed. This plant enables them greatly to increase their output. The wiring for lighting, amounting to $8000, is being done by the Fowler Electrical Supply Company. The power wiring is to come through later.

QUESTIONS AND ANSWERS

All readers are invited to submit questions and answers to this department. Anonymous communications will not be considered. Questions should relate to electrical matters of any kind. Answers contributed by readers should be submitted preferably within eight days of the date of publication of the question and should be limited, if possible, to 300 words. Payment will be made for all answers published.

Questions.

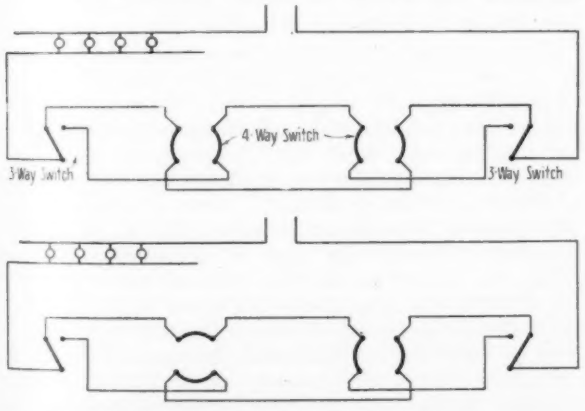
No. 412.—Submarine Radio Signals.—A dispute has arisen between two of my friends respecting the ability of a submarine to receive wireless messages when it is submerged; one man says it can and the other that it cannot receive messages under this condition. The matter has been referred to me and I would like authoritative statements to back up my devision.—H. S. C., Memphis, Tenn.

No. 413.—Electric Room-Heat Regulator.—How does the system of electric thermostatic regulators for controlling the steam heat in rooms operate? I refer to such as are installed in some modern hotels. Is the control circuit of low voltage or 110 volts? How does the system compare with pneumatic regulator systems?—T. J. B., Duluth, Minn.

Answers.

No. 405.—Construction of Four-Way Switches.—I would like some of your readers to furnish a sketch of the actual construction of a four-way switch, such as is used in conjunction with three-way switches for controlling lamps from several points. In the Electrical Review and Western Electrician of March 17, 1917, page 455, there are several clear sketches of such systems, but I do not understand the construction of the switch itself and how it opens and closes the circuit.—V. J. L. N., New York City.

In an answer to this question, published in the issue of November 17, G. A. T. states that "It must be observed that the switch is only for reversing and does not open or close the circuit." It is true that a four-way switch is always in circuit and that it is merely a reversing or rather a transposing switch, but by that action it automatically opens or closes the circuit when used in connection with three-way switches. The accompanying sketches illustrate this point. By tracing



No. 405.—Showing How Reversal of a Four-Way Switch Can Open and Close a Lamp Circuit Controlled From Several Points.

the circuit it can be seen that when one of the four-way switches is thrown to its other position it automatically opens the circuit supplying the lamps; the second sketch shows this clearly. By closing either of these four-way switches the lamp circuit is again closed. If the four-way switch, by merely reversing or transposing the circuit, did not open or close the circuit then there would be no need to install it in the manner shown.—W. T. E., Ansonia, Conn.

No. 407.—Magnetic Brake.—The coils on a magnetic brake for an Otis elevator give trouble by burning out frequently. Each segment has 143 turns of No. 11 wire and two segments are connected in series across 240 volts. I would like suggestions for rewinding the coils to eliminate the trouble without changing the magnetic pull.—S. A. B., Reno, Nev.

Answer A.—The querist does not state whether his elevator machine is operated by alternating or direct current. It is safe to assume, however, that it is an alternating-current machine and that furthermore he has a polyphase type of Otis brake. Let him adjust his brake shoes carefully, so that the extreme movement of each core is limited to three-fourths inch and he may find that his troubles in this particular respect have been eliminated. It is only necessary for the brake shoes to clear the brake pulley by one-thirty-second inch at the most. The writer has found by experience that if these instructions are followed it is likely to be unnecessary to change the brake-coil windings in order to obtain satisfactory service.—H. R. P., Rochester, N. Y.

Answer B.—If double cotton-covered wire is now being used I suggest that Deltabeston wire (made by the D. & W. Fuse Company, Providence, R. I.) be substituted in the same gauge and number of turns and occupying the same winding space. This will stand a working temperature of close to 500 degrees Fahrenheit. If single cotton-covered magnet wire is used, a substitute enamel-insulated wire will occupy 10 per cent less space for the same turns or allow 10 per cent more resistance for the same winding space and will reduce the current thereby to what may be a safe amount and without changing the magnetic characteristics. If enamel-insulated wire is now used, I do not see that the querist will be able to better his coils without changing their size so as to increase the radiation area. It may be possible that a resistance can be cut in automatically after the magnet has operated and which will remain in service as long as the core is at its extreme position. This is commonly done and will allow of full magnet power to start the load while maintaining a less amount for holding purposes. S. A. B. has not supplied sufficient data to make other than a general answer.—W. M. P., Seattle, Wash.

No. 408.—Fishing Wire in Conduit.—In fishing wire in conduit what material may be used for "lubricating" the wire without injuring its insulation? What approved methods are used to aid fishing wire in long conduit runs or in runs with several bends?—A. S. N., Plymouth, Mass.

Answer A.—For such fishing, the lubricant I have always used is powdered soapstone. It can be applied on the wire as it enters the conduit, or blown into the conduit, or both methods may be used for long runs. It makes the wire very smooth and slippery, and it does not injure the insulation, but on the contrary, it has preservative properties and can be used with absolute safety.

The best way to fish wire in long conduit runs with several bends is to insert pull boxes in one or more places in the place of elbows. The number to use depends upon the length of the circuit and the number of elbows. Rule 28*h* of the National Electrical Code states that a conduit run "Must have not more than the equivalent of four quarter bends from outlet to outlet, the bends at the outlets not being counted." The best practice, however, uses even a less number of bends, and uses pull boxes where convenient, one advantage of this being that a pull box makes a convenient point for future connection and extension, if necessary, and another being that in case of trouble it is a convenient point to open up for a test, which

makes it easier to replace a defective wire, etc.; still another advantage is the large amount of labor and time saved in fishing the wire which frequently amounts to much more than one might imagine.—W. T. E., Ansonia, Conn.

Answer B.—Rubber or weatherproof insulated wire can be easily pulled through conduits when given an application of graphite, talc (soapstone), powdered mica or any other of the similar class of lubricants that have no solvent effect on the insulation of the wire.—W. M. P., Seattle, Wash.

Answer C.—The most used lubricant for all general conduit work is powdered soapstone. This will result in no detriment to the insulation. To get a fish wire through a long run of conduit or one with a number of bends, use a common iron wire or the steel wiring tapes made and sold for that purpose, starting these from opposite ends with a hook on each; the idea is to have these hooks meet and your pulling line is then complete. Now to pull the service circuit through with no trouble make the connection between the fishing wire and the service very carefully and tape smoothly and securely. Then for a space of about three feet on the connecting end of the tape rub on as a lubricant some heavy grease; this will enable you where space is small to pull the wire or wires through very easily. You can add to this action by using also the soapstone along the wire or cables as they are drawn in.—F. F. H., Milwaukee, Wis.

Answer D.—I have found pulverized soapstone to be the best lubricant, taking into consideration its harmless effect upon the insulation, leaving it dry, which is not the case when soft soap or Albany grease is employed. It is not considered good practice to employ more than four 90-degree ells from outlet to outlet, or the equivalent thereto, and under normal conditions no trouble will be experienced if a steel snake with a loop on the end is used. The pipe ends should butt in the couplings, which they seldom do owing to the negligence on the part of the journeyman; invariably the result is that the snake sticks in a coupling oftentimes only 30 or 40 feet from the outlet. A very good method to assist the snake in a long run with a number of ells is to carry a piece of twine along from length to length, so that when the run is complete the twine is in the conduit from outlet to outlet. The loop on the end of the snake is attached thereto and a slight pull of the twine combined with the feeding of the snake will prove very satisfactory —G. R. S., Brooklyn, N. Y.

No. 409.—Heat Conservation in Power Plants.—In large power plants I understand every effort is made to conserve all the heat units, as for instance by using the air that has ventilated the generators for draft for the boilers, passing the condensate through a preheater at the top of the condenser, etc. To what extent is it practicable to do this in a small power plant, say one of 1000 to 2000 kilowatts capacity? —R. H. T., Lima, Ohio.

Answer A.—Passing hot air from turbogenerators to the furnace would enable almost the entire heat losses of the generators to be utilized. Whatever be the gain in temperature of the intake air to the fuel bed, so also by the same amount will the furnace temperature gain. The heated air from a turbogenerator is not usually heated more than 40 to 50 degrees above the temperature of the incoming air, hence the gain to a fire that already is around 1700 degrees Fahrenheit would be very small indeed. A small gain in furnace temperature, provided the boiler heating surfaces were in condition to absorb it, is always worth while theoretically. Whether it would be financially worth while using this heated air would depend upon the cost of by-passing the air from generator to the furnace ashpit. A station can be, and a number are, designed for a short duct with low resistance to air flow between generator and fuel bed, but where the station is already built the cost of constructing a duct would have to be very low indeed to show any economy at all, even where all conditions were favorable, as it will now be shown they are not. Moreover, the temperature of the outlet air from a turbogenerator depends upon the load it carries. The quantity of air is constant but its temperature varies with the load. This means that the ability to earn return on the money invested in a duct line depends upon the load-factor of the plant, and the most efficient condition exists only whilst the outcoming air is highest, which probably means during the short peak-load period. Under such conditions the use of generator-heated air would prove financially profitable where the additional heat was considerable, instead of being very small.

But even if the scheme were profitable financially, the question is how much air is there available for use, and does it suffice? No, it does not. The boilers require a certain amount of heat for a definite quantity of steam-making. The amount of coal required to furnish this heat depends upon the condition of the boiler heating surfaces, and their ability to absorb it, an ability affected by scale and soot, efficiency of combustion and of the furnace. The efficiency and rate of combustion both depend upon the air supply. Knowing the requirements of the fuel bed for air, it is a simple matter to determine the total volume of air and to what extent that supplied by the generator meets the demand. Comparison in this way will show that the furnace requires from 30 to 50 per cent more air than the generator is able to supply, and the deficiency will be even greater where low-grade fuel is burned. This means that it will be necessary to obtain additional air from the boiler room or outside to make up for the deficiency of preheated air from the generator. This additional air will so reduce the temperature of the air preheated by the generator losses as to make negligible any saving originally obtained, which has been shown to be very small in any case.

In using the exhaust air from the generators it is important to have ample duct area, minimum number of turns and short length of duct because otherwise loss of heat would occur and the resistance offered to air flow, coupled with partial closing of the ashpit dampers, may so interfere with air flow as to retard ventilation of the generator. Many stations use the air from the generators to warm the station in cold weather. This is one way of using the heat that otherwise would be wasted. Instead of routing this air direct to the ashpit, why not allow it to escape into the boiler room, where it can escape through doors or find its way into the ashpits and through the fuel bed at will? The writer knows one station that has a by-pass damper in the duct between generator and ashpit to permit by-passing the air into the station in winter instead of into the ashpit, the fact that the heater air is required by the furnace more in winter than in summer being apparently overlooked.

Air preheaters are sometimes installed in the same way that economizers are installed, namely, in the uptake. However, under normal circumstances it is better to preheat the feed-water rather than the air, since the same amount of heat is utilized in both cases, but heating the water instead of the air results in a higher percentage of heat being really regained.

Instead of trying to utilize heat that can be conserved only with difficulty and after expense, there is probably greater reward, also obtained much easier and more quickly, by redeeming lost steam from leaky valves and pipes, lost heat and condensation due to poor insulation of steam pipes, heat lost through settings, dirty heating surfaces, etc.—I. L. K-R., Chicago, Ill.

Answer B.—The conservation of all the heat units possible in connection with steam-electric power plants such as the use of draft to boilers of the air heated by ventilation of the generators, passing the condensate through a preheater at top of the condenser, using the water which has gained heat in cooling bearings or transformers, use of economizers, and the utilization of all the exhaust steam of auxiliaries for heating feed water, etc., is just as essential to the economy of operation of the small plant of 1000 to 2000 kilowatts as of the large plant and really as practicable. This matter has not received the same attention in small plants as in large plants, due to the low load-factor of the small plants as a rule and because a great many of the small plants are more or less temporary, also owing to the rapid growth of the electric power business the small plant of small units is soon outgrown, all of which render the first cost of the extra heat-conserving devices unwarranted. The extent in economy effected by these different items will vary as to conditions, such as location and load-factor.—J. F. F., Toledo, Ohio.

No. 410.—Magnetic Properties of Nickel-Plated Brass.—In making a nickel-plated brass body for compasses, we recently have occasionally had trouble from certain batches of the bodies showing that they were magnetized more or less. The plater claims they are all handled the same way and treated exactly alike. We sometimes get hold of some of the compass bodies plated many years ago in the same plating outfit and these are entirely free from magnetic effects, although plated more heavily than we now plate them. Now on certain days a large percentage of the bodies is found magnetized, while on other days the output is practically free from this trouble. As a compass must be free from such difficulties, we should like some help in clearing up the cause of the trouble.—C. E. H., Grand Rapids, Mich.

Answer A.—I attribute the trouble mentioned to three causes. There is in the bath some iron dropped in, no doubt, accidentally or some scalings from some work that was treated in the same solution; or it may be from an iron wire hook used to hang the nickel in the bath while plating; or it may be in the nickel itself. This occurs quite frequently. Usually it is hardly perceptible, but very detrimental when it shows up on just such work as described (compass cases). I would suggest a new solution, thorough cleaning of the plating vat, and particular notice that only the nickel anode is in the bath and that the hook usually employed to hang same on the rod above the vat does not touch the solution. I can assure you it is not possible to attribute any fault whatever to the brass. So I feel assured that by going into the details mentioned you will find the trouble as above stated can be easily removed. The thickness of the plating will have no effect either way.—F. F. H., Milwaukee, Wis.

Answer B.—Nickel is a magnetic metal, the intensity of its magnetization being from one-fourth to one-third that of iron for the same magnetizing force. Therefore, if all the compass cases were magnetized we might assume that it was due to the magnetic properties of the nickel. As only part of the cases are magnetic and the proportion varies from day to day the trouble is evidently due to some other cause and one that varies from time to time. The anodes which are replaced as they are dissolved offer the best opportunity of introducing a variable into the operation. If cast anodes are used they probably contain iron and the precentage of iron may vary in the different castings. W. B. Bancroft[1] says that the reason cast nickel anodes are more satisfactory in a nickel-ammonium sulphate solution than rolled anodes is that the iron which the former contain causes them to dissolve more readily. When these impure anodes are used the iron also goes into solution and part of it is deposited with the nickel. Ewing[2] has shown that of two specimens of impure nickel an increase from 0.56 to 0.75 per cent of iron caused a 25 per cent increase in the magnetic properties of the specimens. Therefore, if impure anodes are being used the variation in the product might easily be due to the variation in the amount of iron they contain. The use of pure nickel anodes in a nickel-ammonium sulphate solution to which a very small percentage of ammonium chloride or nickel chloride has been added should remedy the trouble. The chloride is added to cause the nickel to dissolve more quickly as pure nickel does not readily dissolve in a nickel-ammonium solution—F. E. V., Madison, Wis.

No. 411.—Tertiary Winding on Induction Coil.—Please explain the purpose and action of the tertiary winding in a tertiary-wound induction coil, such as those used on some types of American Telephone & Telegraph Company's telephone switchboards.—F. G. H., Birmingham, Ala.

The tertiary winding is used in connection with the busy-signal circuit to the operator. To test a line for "busy," the operator touches the tip of the calling plug to the ring of the multiple jack of the party to be called. If the line is already in use, the battery will be connected on the ring and current will flow through the plug tip through the tertiary winding to ground. As the operator's head set is connected to the secondary winding of the induction coil she will hear a noise or click. If the line is not in use, the battery will not be connected to the ring of the multiple jack and there will be no circuit, consequently no sound.—H. E. W., Chicago, Ill.

Illinois Companies Ask Permission to Run High-Tension Transmission Lines.—The Central Illinois Public Service Company, of Mattoon, and the Canton Gas & Electric Company, of Canton, Ill., have filed a joint petition with the Illinois Public Utilities Commission, asking that the latter company be permitted to run its high-tension transmission lines from Ipava to Lewistown, Ill., and for the former company to conduct a transmission line from the West Havana (Ill.) substation, across the Illinois River, to the southern terminus of the Canton Gas & Electric Company's present lines; also for the Canton company to construct a transmission line to serve the Liverpool Drainage and Levee District; and finally for the approval of the Commission of an incorporate working agreement between the two companies.

Electric Warming Makes Oil Flow Faster.—A novel method of hastening the unloading of tank cars of oil in winter is to heat the oil by an electric heater, which makes it flow more freely, releases the car sooner, saves demurrage charges, and is free from fire risk. The electric heater used for this purpose is of the immersion type, and has been used also for accelerating the handling of cocoanut oil in tanks and barrels.

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[1]See Transactions American Electrochemical Society, Volume IX, page 217.
[2]Ewing: "Magnetic Induction in Iron and Other Metals."

BOOK REVIEWS

"Standard Tables of Electrochemical Equivalents and Their Derivatives." By Carl Hering and Frederick H. Getman. New York: D. Van Nostrand Co. Imitation leather, 130 pages (4¼ by 7½ in.), illustrated with 8 line drawings. Supplied by Electrical Review Publishing Company, Inc., for $2.00.

The heart of this handy little book is the tables which it contains and especially the table indicated in the title. Three other and shorter tables are supplementary to this. The main table gives a list of the chemical elements, their symbols and atomic weights, and in six additional columns the electrochemical equivalents of each element in most of the valence variations which are known to ever occur. The electrochemical equivalents are given in milligrams per coulomb, coulombs per mg., grams per ampere-hour, amp.-hrs. per gram, pounds per kiloampere-hour, and amp.-hrs. per lb. By thus giving the values in nearly every unit which may be required, calculations by the user are reduced to a minimum, and even values in kwhrs. can be easily found by bringing in the voltage as a factor. Table II collects the grams per amp.-hrs. for the elements in the order of their magnitude. Table III gives the equivalents in terms of volume for the common gases. Table IV gives the different valences for each element and the classes of compounds in which they occur.

The remainder of the book, including the appendices, consists of explanatory matter and brief presentations of the dissociation theory of solution and of the electron theory. The explanatory matter involves considerable repetition and could be condensed to advantage. The few paragraphs dealing with the silver voltameter could be improved. Thus on pages 65 and 67 different values are given for the concentration of silver nitrate, and the use of filter paper is directed, whereas this has been found to be a source of contamination of the solution, leading to incorrect results. The authors propose two innovations in terminology which seem to be well conceived. One involves a distinction in meaning between "valence" and "valency." The other is the use of "adduction" in place of oxidation in the larger significance as the reverse of reduction.

The book is mechanically well made and will prove of great value to electrochemists and others concerned with electrolysis problems. M. G. LLOYD.

"Applied Motion Study." By Frank Gilbreth and L. M. Gilbreth, Ph. D. New York: Sturgis & Walton Company. Cloth, 220 pages (5x7½ inches), illustrated. Supplied by the Electrical Review Publishing Company, Inc., for $1.50.

George Iles has written an introduction to this book and he says: "Blessed is the man who makes two blades of grass grow where only one grew before. More blessed is he who multiplies the harvests of toil not merely two-fold, but three-fold or more-fold, for he virtually lengthens life when he adds to its fruitage. Such a man is Frank B. Gilbreth who tells in this book just how he wrought this wonder."

The book presents in outline: (1) The field where motion study has been and can be applied. (2) The methods by which it is applied. (3) The effects of the application.

In addition there is a chapter upon "Motion Study for the Crippled Soldier," a problem which it is sad to contemplate will confront this nation within the next few months.

"Public Utility Rates." Harry Barker, B. S. New York: McGraw-Hill Book Company, Inc. Cloth, 387 pages (6x9 inches). Supplied by the Electrical Review Publishing Company, Inc.,

Ever since the organization of the public utility commissions the bases of just and reasonable rates for public utility service have been carefully scrutinized, and as a consequence considerably modified. Many of the cases that were decided by the utility commissions have been appealed to courts for final adjudication, and accordingly there have been evolved, both through the actions of the commissions and the courts, certain fundamental principles and practice underlying charges for public utility services. This book is a remarkably lucid discussion of these fundamental principles with reference to their application in determining reasonable rates for water, gas, electricity, communication and transportation utilities.

The author has had an unusual opportunity for impartial study of public utility rate problems. On account of the fact that he is not affiliated with either a public utility or regulating commission, his interpretations of the essential elements of rate problems are thus more free from prejudice and preconceived notions than would otherwise be the case.

In reading the book the reviewer was impressed with the analytical power, unbiased viewpoint, and clearness of statement evident on every page. Throughout the book there are evidences of painstaking care in the preparation and the formulation of the material which is in marked contrast with some of the literature on the subject.

In a brief review it is impossible to do justice to a book which contains so much material on utility problems stated in such a logical and unambiguous manner. To appreciate these characteristics of the book, it must be read. It may not be amiss, however, to point out some of the wealth of material it contains. Among the more important subjects treated are: Development of Utility Regulation; Utility Privileges and Obligations; Rights of the Public; Product and Service Companies; Definitions of Rates and Service; Various Bases for Rates; Fair Value of Utility Property; Valuation as an Engineering Task; Appraisal of Land and Water Rights; Reasonable Return; Extra Profits; Depreciation as it Affects Utility Rates; Miscellaneous Problems; Problems of Railway Rates; Problems of Express Transportation Rates; Rate Problems of Street and Interurban Railway Transportation; Problems of Water Rates; Rate Problems of Gas Utilities; Rate Problems of Electricity Supply Works; Problems of Telephone Rate Making.

Each of these subjects is treated fully and in a judicious, impartial spirit. As an example the author's treatment of "water rights" may be cited. The subject of water rights is a bone of contention between legislators and a large part of the public on the one side and the owners and would-be developers of water powers on the other. A better understanding of the various elements that enter into water rights and their evaluation would be acquired if everyone concerned familiarized himself with Chapter VI of this book. In substance the same thing can be said of other chapters. It is to be hoped that the book will have a wide circulation, for no manager of a public utility, nor any one who has to do with utility problems, can afford to be ignorant of its contents. The reviewer is glad of the opportunity to recommend it. C. M. JANSKY.

New Appliances

Porcelain Locking Sockets—Safety Extension Fixtures—Safety Switches and Meter Protectors—Horn-Gap Swiches—Twin Plug

Poreclain Locking Sockets and Receptacles.

The General Electric Company has a new, improved line of porcelain locking sockets and receptacles for use in places where the socket is exposed to corroding influences, such as acid, fumes, moisture, etc. A lamp installed outdoors, in the cellar, or some similar place, is most likely to be stolen, hence the need of the locking socket. Sockets installed in such places are most likely to be subjected to corroding influences, requiring the use of porcelain locking sockets.

G.-E. Porcelain Locking Socket.

These sockets take the standard G-E locking-socket interiors and are therefore interchangeable in porcelain and metal shells.

The principle of design is such that when the locking key is removed the lamp swivels freely, preventing injury to either the lamp base or the socket, if an attempt is made to remove the lamp without the key.

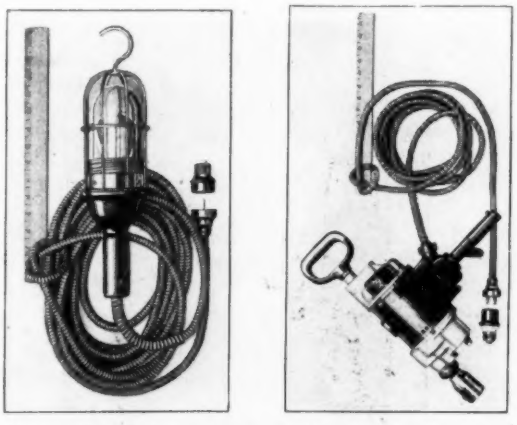
The receptacles are furnished in both key and keyless types, with bases for cleat, concealed and molding work as well as bases for 3.25 and 4-inch outlet boxes. Caps, bodies and bases are interchangeable.

Steelite Safety Extension Fixtures for Industrial Use.

The Inland Electric Company, 14-16 North Franklin Street, Chicago, Ill., has recently put on the market a line of fixtures called Steelite, which are of timely interest because of their many safety features and long life. Several styles are made, two of which are illustrated herewith.

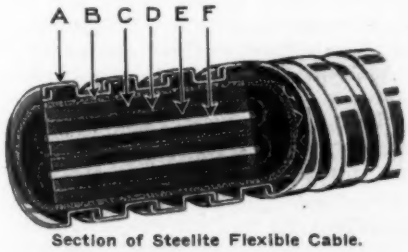
Style PVG2 fixture has a black wood handle with a stout steel guard and vaporproof globe, which incloses the lamp in an air-tight space, making the fixture suitable for use in and near explosives, gases, liquids and powders. The cable is of new design, armored with a steel ribbon formed with interlocking flanges which give it a maximum strength and flexibility. The conductors are very heavily insulated, so that there is no possibility of a ground on the armor. The cable as it enters the handle end of the fixture is reinforced by an additional armor that takes up the strain, which is greatest at this point. On the opposite end of the cable is a separable attachment plug which is screwed on a bushing that in turn is sweated to the armor. The cap of the plug is filled with compound so that foreign matter cannot enter at this point.

Each fixture is approved and carries the Underwriters' Laboratories' label. The fixtures after being assembled are carefully tested before packing. These fixtures are said to last years in places where the common type of portable cable wears out in weeks. They are light in weight, a fixture with 25 feet of cable weighing only six pounds.



Steelite Extension Fixtures, Styles PVG2 and PREF.

A section of the cable is shown herewith. It is said to be so flexible that it can be formed in a loop with an internal diameter of five-eighths inch. The tensile strength of the armor is 160 pounds. It has a peculiar property that it will not kink or tangle. Rubber-tired auto trucks will not injure the cable if the latter is run over by them.



Section of Steelite Flexible Cable.

Style PPG fixture is of the same general construction as mentioned above, with the exception of the guard, which is of the open type designed for use in the average factory or warehouse.

A drill extension (style PREF)) illustrated herewith is also made, which is said to overcome the cord trouble that is nearly always present on electrical devices of this kind.

Compro Inclosed Switches and Meter Protective Device.

The steady increase in use of electric motors in factories and shops of all kinds is developing the need of protective devices to safeguard the employees from any possible contact with live electrical parts, and this is especially true just now when so many men are answering the nation's call and their places are being replaced by men, boys and even women untrained in handling electrical equipment. Probably the most common source of electrical hazard in such installations is the open knife switch usually employed on motor circuits. This danger is being overcome by the use of various types of inclosed switches, of which the one illustrated herewith is a new development.

This switch is known as the "Compro" device and is adaptable to several uses. It is inclosed in a substantial steel box, of which the sides and back are in a single piece. The switch proper is made in various standard sizes and capacities. It is securely mounted on the back of the box and arranged to be operated by the outside handle at the right. With the handle swung up the switch is closed, with the handle down it is open. A fuse chamber in the upper part of the box has a separate lid that is locked when the switch is closed and can be opened only after the switch is opened.

The steel front or cover of the box is secured by either a lock or seal; it also can be removed only after the switch is opened and the parts then exposed are dead. From this it is evident that fuses can be readily replaced without removing the entire front

Compro Inclosed Motor or Commercial Switch, Showing Switch in Open-Circuit Position and Fuse Compartment Open.

of the box and always without danger because no exposed parts are live. A further precaution provided for is a lug at the lower right side to permit locking the switch in its open position; this prevents anyone closing the circuit while repairs are being made or when the service on the circuit is to be cut off for any reason. The switch is very easily wired. On removal of the front plate it is possible to remove the ends of

Installation of Main Service Switch and Three Customers' Switches and Meters, Employing Compro Meter-Protective Device and Switches.

the box and the fuse chamber so that the box may be quickly mounted on the wall or post and its terminals readily connected to the circuit.

From the above brief description of the device it is evident that it meets very satisfactorily all requirements of a motor switch or inclosed main or branch-circuit switch, or any similar purpose. Thus it also may serve as a main service switch and, in connection with a set of special but simple motor adapters, as a very reliable customer's service switch and meter-protective device. In the second illustration herewith is shown an installation of a main service switch, three meters and customers' switches. It is clear that there is no open wiring whatever in such a job. The meter connections are all closed and sealed, all of the wiring is in conduit and by the use of angle fittings a very compact installation is obtained. In the installation shown above a space of only 20 by 22 inches is required. A very decided advantage in such an installation is, aside from its safety features, that all efforts at theft of current or tampering with the wires are prevented. This means a great relief to central-station companies from serious losses due to this criminal cause. It also facilitates meter connecting and testing. It makes a very neat and foolproof installation. Any standard meter can be used, since adapters are available for all such types. When the meter and switch box are sealed, they need not be opened for replacing fuses. If service is discontinued for any particular customer, the meter need not be removed, but the switch can be locked in its open position, thus the expense of meter disconnection, removal and reconnection is eliminated.

This switch is of simple design and has but few parts. It is substantially built to withstand all requirements of the various services for which it may be used. It is easily installed and can be quickly adapted for either meter, motor, or general service purposes. These switches and auxiliary adapters are made by the Wadsworth Electric Manufacturing Company, Covington, Ky. They have been tested and approved by the Underwriters' Laboratories both as to fire and accident safeguards.

Burke Horn-Gap Switches.

The rapid development of electric power service to steel works, coal mines, quarries and other industrial plants, to small towns, electric railway lines and other isolated power purchasers has been due in large measure to the development of inexpensive and reliable outdoor substation equipment, notably outdoor transformers, air-break switches, lightning arresters, etc. Such

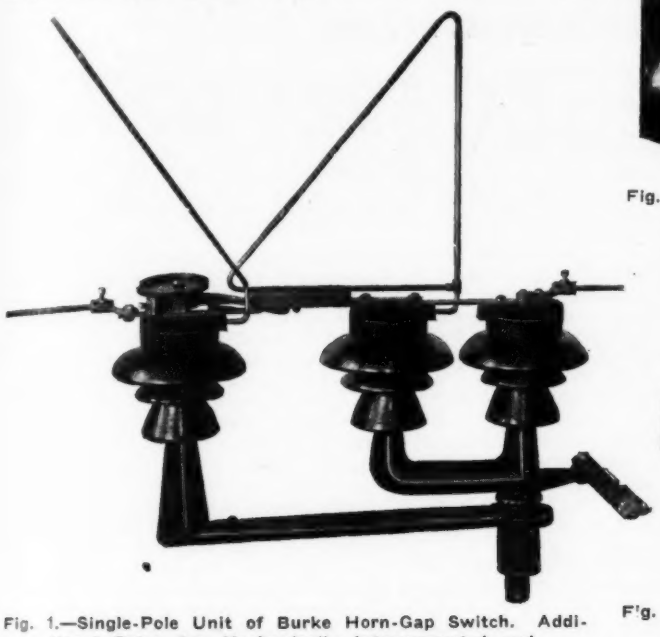


Fig. 1.—Single-Pole Unit of Burke Horn-Gap Switch. Additional Poles Are Mechanically Interconnected and Operated from a Single Handle.

equipment has permitted economical service from high-tension transmission lines without the heavy expenditures required for substation buildings and their customary oil-switch and other equipment.

A new line of air-break switches has recently come into quite extensive use that promises to extend the field of the outdoor substation because of the excellent service these switches give. These switches are known as type B Burke horn-gap switches and they are made in various sizes and for voltages from 6600 to 150,000.

The accompanying cuts illustrate a single-pole unit of this Burke horn-gap switch. This switch is designed to be opened under heavy loads. Auxiliary arcing horns protect the flexible-leaf brush contact shown in Fig. 3 from all arcing. Fig. 2 shows that this brush contact opens before the horns separate. The arc on movement of the horns is dissipated by being allowed to rise on the horns until it breaks. In closing the switch, the horns come into contact before the main contact closes.

By comparing Figs. 2 and 3 it will be seen that the flexible-leaf brush contact is completely covered by a sleet hood which protects the switch from freezing under the most severe weather conditions.

The switch arm is jointed with a toggle, with the shorter section held normally at an angle by a phosphor-bronze spring, which is inclosed in a square brass housing. In closing the switch, this shorter section engages the brass block and a further motion of the rotating member straightens out the switch arm and brings the contact block into firm compression with the laminated-copper-leaf brush. This toggle joint also gives an increased reliability of break.

Two insulators are used on the rotating section to prevent torsional strains, such as would tend to loosen

Fig. 2.—Horns in Contact Before the Main Contact Closes, Also Remain in Contact Till After Main Contact Opens. Sleet Hood Shown in Place.

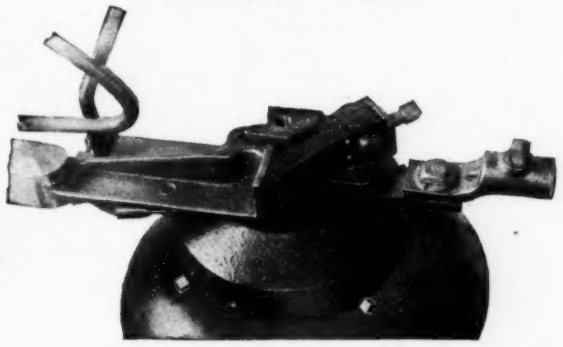


Fig. 3.—Sleet Hood Removed to Show Main Laminated-Brush Contact Closed.

the insulators between the sections or from the supporting pins.

An adjustable interconnecting rod provides for the simultaneous operation of duplicate poles of the switch. A single operating handle, together with a locking device, is used to open or close the switch and lock it in either position. This switch is manufactured by the Railway & Industrial Engineering Company, Pittsburgh, Pa.

Twin-Outlet Separable Attaching Plug.

A recent addition to the line of the General Electric Company's separable devices is a porcelain twin-outlet, separable attaching plug. By the use of this device two portable devices, equipped with standard caps, can be connected to the same outlet. A feature of this improved plug is the length of the stem, which

Twin-Outlet Attaching Plug.

is of sufficient length to enable the device to be screwed into a socket or receptacle having a shade attached.

Trade Activities

Many Manufacturers Enlarging Quarters—Instructive Catalogs Distributed—General Electric's Response to Loan

National Carbon Company, Cleveland, Ohio, is building a two-story factory building at its Cleveland works. The estimated cost is $50,000.

United Electric Construction Company, 101 Park Avenue, New York, has acquired property at 353 West Thirty-ninth Street, to provide for increased capacity.

Wagner Electric Manufacturing Company, St. Louis, Mo., announces the opening of a sales office at 129 Church Street, New Haven, Conn. This office is in charge of C. M. French, formerly representative at Springfield, Mass.

General Vehicle Company, Inc., Long Island City, N. Y., announces with respect to certain rumors circulated, that while a considerable portion of the Long Island City plant will be devoted to other work than the manufacture of electric trucks, the manufacture of electric trucks will continue, and its business of 17 years' standing will continue as in the past.

Electric Service & Power Equipment Company, Grand Rapids, Mich., has established quarters at 25 South Ionia street, to act as sales agent for the Howell Electric Motors Company of Howell, Mich., and to handle other classes of equipment for wood-working and metal shops. J. Brown, William Brummeler and R. A. Carley are among those interested in the new concern, Mr. Carley being an electrical engineer. The Howell company manufactures induction motors of a new design.

McMullen Machinery Company, Grand Rapids, Mich., recently sold 12 motors and other electrical equipment for the Llewellyn Bean Company plant, Grand Rapids. These are the Wagner motors, ranging in capacity from two to 15 horsepower, and are for driving, cleaning and drying machines and conveyors, by belt connections. This company also put in 14 Wagner motors, of two to 20 horsepower, in the new shops of the Sturgis Go-Cart Company, at Sturgis, Mich., mostly for driving shop tools. The McMullen Company carries a heavy stock of motors.

The Curtis & Curtis Company, corner Railroad Avenue and Garden Street, Bridgeport, Conn., is sending out a catalog, Edition No. 14, on its improved and perfected Forbes' patent pipe cutting and threading machinery, which it manufactures. These machines are made for hand, belt or electric power operation and were awarded the highest medal for excellency at the Paris Universal Exposition in 1889 and at the World's Columbian Exposition of 1893. These complete self-contained pipe cutting and threading machines are the result of 30 years' practical experience and are the only machines on the market with receding gear carrying the dies onto the pipe and also with shell adjustable, so that the wear may be taken up and the life of the gear greatly prolonged. Illustrations, descriptions and prices on the different styles of machines, including motor-driven, are given, also on the Curtis' patent nipple holder and Curtis' patent pipe-threading attachment for lathes.

The De La Vergne Machine Company, New York City, has been acquired by the Wm. Cramp & Sons Ship & Engine Company, of Philadelphia. No changes will be made in the De La Vergne organization, with the exception of a new board of directors. The new owners will continue with the oil-engine and ice-machine business and the De La Vergne shops will also assist in the production of marine steam engines and other work now being fulfilled by Wm. Cramp & Sons Ship & Engine Company for the United States Government. President Carroll S. Smith, of De La Vergne Machine Company, in commenting upon the change said: "It is our intention to continue the ice-machine and oil-engine business, and Wm. Cramp & Sons Ship & Engine Company will co-operate in every possible way to develop these lines. De La Vergne will build marine turbines and other similar work in its shops at the same time." Every step will be taken to foster the present state of the organization.

Enterprise Electric Novelty Company, 137 Greene Street, New York, has leased the third, fourth, fifth and sixth floors of the building now occupied to provide for increased capacity.

Phoenix Electric Company, Mansfield, Ohio, will build a one-story factory, 50 by 100 feet, at an estimated cost of $10,000. Althouse & Jones are the architects. A. C. Linzee is manager of the Phoenix Electric Company.

Arthur Jones Electric Company, manufacturer of electrical machinery, automobile electrical equipment, etc., announces the removal of its general offices and salesroom to larger quarters at 2837-2843 South State Street, and its Service Station to 8 East 29th Street, Chicago, Ill.

Westinghouse Electric & Manufacturing Company, Pittsburgh, Pa., has awarded a contract to J. F. Fullman, East End Savings & Trust Building, Pittsburgh, for the construction of a two-story addition, about 52 by 112 feet, to its transformer building at Trafford City.

Pass & Seymour, Inc., Solvay, N. Y., manufacturers of electrical specialties, have completed the construction of a large factory building, and are planning to install the necessary equipment immediately. The firm expects to have the new structure ready for occupancy before the close of the year.

Northwestern Electric Equipment Company, distributor of Fostoria Mazda lamps, St. Paul, Minn., has opened a division sales office and warehouse in Duluth, Minn. This new branch, known as the Northwestern Electric Equipment Company, Duluth, is in charge of A. M. Baldwin, Jr. Complete stocks of electrical supplies will be carried at Duluth and with the ample dock and railway facilities there the company is in position to take care of its ever-increasing business.

The Central Telephone & Electric Company, importer, manufacturer and jobber, 310-12 North Eleventh Street, St. Louis, Mo., is sending out copies of its new 1918 catalog. This catalog is unique, as it describes and illustrates only the appliances and products for which the company is distributor and which it carries in stock. It is a strong, clothbound book of the loose-leaf type and has been made the exact size of the jobbers' association catalog. Copies may be had on application. While this catalog does not present every item in every line the company represents, it is made for quick reference to locate the articles most in demand and to show specialties. Some of the articles manufactured by the company are flashlights, Xmas tree outfits, telephones, lightning arresters, Ajax plural plug sockets, a line of weatherproof sockets, porcelain flush receptacles, portable lamps, etc., and it is always ready to use its factory facilities to make special articles or repairs as accommodation to customers. It carries one of the largest lines of Gilbert and Lionel toys in stock of any electrical jobbing house known.

General Electric Company's employees responded even more liberally to the Second Liberty Loan than the first. The total for the Second loan was $3,447,500, against $3,002,850 for the first loan. The complete figures for the company's offices and plants are as follows:

	First Loan		Second Loan	
	No. Subs.	Amount.	No. Subs.	Amount.
Schenectady Works, including general offices	13,309	$1,057,400	20,905	$1,497,600
Lynn Works	8,737	559,800	9,111	555,000
Pittsfield Works	4,145	287,400	4,413	289,050
Erie Works	2,384	177,450	2,360	160,050
Fort Wayne Works	2,129	152,050	2,922	196,600
Edison Lamp Works	3,212	213,650	3,387	200,250
Sprague Electric Works	802	57,850	594	56,450
National Lamp Works	3,389	278,200	2,908	250,400
District Offices	1,748	219,050	1,717	224,100
	39,855	$3,002,850	48,317	$3,429,500
Foreign and Selling Companies			23	18,000
Total	39,855	$3,002,850	48,340	$3,447,500

Men in Service

Commonwealth-Edison, Boston-Edison and Emerson Electric Employees Serving Under the Colors

W. H. Noble, district manager of the Lincoln Electric Company, at Chicago, Ill., has been commissioned 1st lieutenant in the Field Artillery. Lieut. Noble attended the Second Officers' Training Camp at Fort Sheridan, Ill., which closed last week.

Douglas M. Wood, manager of the illumination department of the Bryan-Marsh Works of the General Electric Company, Chicago, Ill., has been commissioned 1st lieutenant in the Field Artillery. Lieut. Wood makes the seventh employee of the Bryan-Marsh Works that has entered Government service.

Lux Manufacturing Company, Hoboken, N. J., in its November issue of Lux Side-Lights, the second number of this interesting little house organ, states that R. R. Brady of its Electrical Testing Laboratories has enlisted in the Signal Corps of the U. S. Army and will go into training at Wrightstown

E. W. Roth, formerly manager of the pole yard and treating plant of The Lindsley Brothers Company at Minneapolis, Minn., who was assigned to Battery A, 337th Field Artillery, National Army, at Camp Dodge, Ia., has been promoted to ordnance sergeant, senior grade, of the regiment. He has also been recommended to the Third Officers' Training Camp.

Gardner S. Williams, civil electrical engineer, Ann Arbor, Mich., has been in service since last July, having been No. 15 in the Engineer Officers' Reserve Corps, and has the rank of major. He served some time as chief engineer on the Construction Quartermaster's staff, at Camp Bouregard, Alexandria, La., and is now attached to the Division of cantonment construction, at Washington, D. C.

Commonwealth Edison Company, Chicago, which has over 500 of its employees in service, in its December 1 issue of the Edison Round Table Weekly gives the names and ranks of eight of the 12 of its men, enrolled in the Second Officers' Training Camp at Fort Sheridan, Ill., who have been given commissions. The lucky eight are: C. W. Bontemps and W. G. Copeland, distribution department, now 1st lieutenants, Coast Artillery; F. E. Ashton, Jr., statistical department, 2d lieutenant, Aviation Corps; C. H. Fisk, street department, 1st lieutenant, Aviation Corps; C. P. McCaskey, Bureau of Co-operation, 1st lieutenant, Infantry; A. C. Melville, distribution department, 1st lieutenant, Infantry; E. A. Smith, Northwest Station, 1st lieutenant, Infantry; A. C. Touche, load dispatcher's office, 1st lieutenant, Engineers. Two other men, relatives of members of the Commonwealth Edison, also received commissions at Fort Sheridan. They are Arthur Abbott, 1st lieutenant, 42d Regular Infantry, assigned to Fort Dodge, Ia., and Frederick C. Seymour, 1st lieutenant, Artillery, assigned to Camp Pike, Little Rock, Ark. Lieut. Abbott is a son of W. L. Abbott, chief operating engineer, and Lieut. Seymour is a brother of H. A. Seymour, editor of Electric City Magazine and of the Edison Round Table Weekly.

ROLL OF HONOR.

The electrical industry, perhaps to a greater extent than any other industry, has answered the call of the Nation for men. As this is a war of engineers, naturally the technically trained men in the electrical industry have been in great demand and they have responded with splendid patriotism. Many of the large utility and industrial corporations have assigned men for Government service aside from those who have voluntarily entered or been called for service.

The Electrical Review will *welcome news concerning men who have entered the service or who are engaged in any patriotic duties.*

Emerson Electric Manufacturing Company, with main office and factory 2024-32 Washington Avenue, St. Louis, Mo., and eastern office 50 Church Street, New York City, in its December issue of The Emerson Monthly, gives the names of 90 Emerson employees in military service. They are as follows: Ambulance Corps—H. L. Parker, jr.; Engineering Corps—J. Barnard; Marines—M. Alfers, E. Baun, W. Hollenbach, L. P. Paul and H. S. Smith; National Army—G. Bauman, B. Beeler, B. M. Bining, H. Bohland, J. L. Brenneman, F. Budde, H. R. Buschhorn, F. L. Cabell, T. E. Clark, G. Dain, R. L. Dorn, E. Ebner, G. Echrich, G. J. Garret, F. D. Gilbert, T. M. Hager, M. J. Hanvey, F. J. Harker, W. W. Hays, G. Johnson, H. Lake, L. Laurent, B. H. Lueken, T. Maloney, C. T. Miller, King L. Parker, E. T. Pfeffer, H. Raphael, H. Reber, F. Y. Sachleben, H. J. Scherper, E. Schreiber, H. Schroeder, M. E. Smith, W. Storey, W. Thiemann, F. J. Thomure, A. Thorpe, R. Walker, H. Weiss, R. E. White, A. A. Williams and C. Wollenberg; National Guard—H. S. Althoff, W. H. Boggs, E. W. Brockemeyer, E. Burns, Charles Cooley, H. Geldbach, H. Goellner, J. Gruner, R. Gruner, C. O. Hoffman, G. Larson, W. Lichtenberg, A. Oakes, M. Phillips, T. Schulz, Charles Spencer, A. R. Teeters, M. Whelan and R. Wren; Naval Militia—G. T. Dunn; Naval Reserves—R. P. Mitchell; Navy—L. Haffner, W. Herrin, E. Kane, W. B. Kelleher, A. Klaile, E. W. Manning, V. McDonnell, E. V. Moore, A. L. Naw, A. Nettman, G. Salerno, E. Swoboda, L. Tochtrop, J. M. Turner, E. A. Van Horn, F. Wamsley, H. Williams and C. Woolbrett; Signal Corps—F. Fillo.

George H. Harris, of the Byllesby organization, who has been Brigadier General in charge of the 59th Depot Brigade at Camp Cody, Deming, N. M., for the last several months, has been transferred to Camp Jackson, Columbia, S. C., in command of the 186th Infantry Brigade.

Maj. Frank L. Shuman, S. R. C., is now a full-fledged major, having recently received notification of his promotion from captaincy to the grade of major. Since the enlisted men of the signal corps were ordered into the various training camps Major Shuman has been acting commander of the 309th Field Signal Battalion at Camp Zachary Taylor, Louisville, Ky., although holding a captain's commission. For several years he was district manager for the North Dakota Independent Telephone Company in plant, traffic and commercial affairs. He had charge of half of North Dakota. Last spring he bought a controlling interest in the Mandan Telephone Company, of Mandan, N. D., of which he is now president. He is also president of the Hazen Telephone Company, Hazen, N. D.

Edison Electric Illuminating Company, Boston, Mass., in its December issue of Edison Life, prints letters received from three of its employees in service. These are J. F. Holman, with Company F, 14th Engineers, A. E. F., somewhere with the British Expeditionary Force, Lieut. Barry Keenan, 102d Machine Gun Battalion, "somewhere-in-France," and 1st Lieut. John A. Herlihy, 109th Squadron, who was located at Camp Kelley, San Antonio, Tex., now reported to be in Garden City, Long Island, and preparing for overseas. The boys of the electrical engineering department have jointly written and mailed a 20-foot Christmas letter to Lieut. Barry Keenan, perhaps the longest letter ever written to any of the boys at the battle front. The company has 212 stars on its service flag, representing employees in the various branches of service, and some of the others, besides the foregoing, given special mention, are Henry S. Bryant, assistant superintendent of the appliance department, who enlisted in the Supply Division of the Aviation Section of the Signal Corps October 23 and is now at the Ground Officers' School at San Antonio, Tex.: Lieut. Lester Watson is in charge of the Northeastern Department of the Aviation Section, Signal Corps; Stanley Wilson successfully passed his examinations for chief gunner's electrician and now ranks 1st lieutenant in the Naval Reserve Force: William Gillespie, only 18 years old, has enlisted in the Naval Reserve Force; Arthur J. McEachern, of the purchasing department, is doing his bit at Camp Devens, Ayer, Mass.; Bill Haggerty has enlisted in the Aviation Corps. The names of 127 men are listed as having received knitted articles from the Edison Red Cross Aid.

Personal

H. M. Byllesby and Samuel Kahn Re-elected—Charles Proner Joins Wales Advertising—W. G. Lawrence Opens Office in Toledo—Other Changes

E. A. Fox has been appointed superintendent of electrical distribution of the Charleston Consolidated Railway & Lighting Company, Charleston, S. C.

L. H. Kistler has been appointed electrical engineer for the Northern California Power Company, San Francisco, succeeding R. E. Frickey, resigned.

H. T. Gille, sales manager of the Pudget Sound Traction, Light & Power Company, Seattle, Wash., is making a business trip to many of the eastern cities.

C. A. Cremer, formerly with the Consolidated Car Heating Company, Albany, N. Y., is now with the Pittsburgh district office of the Westinghouse Electric & Manufacturing Company.

Peter Witt, street railway expert of Cleveland, Ohio, has been retained by Trenton, N. J., officials to investigate trolley conditions and make recommendations for such improvements as may be deemed necessary.

O. W. A. Oetting has joined forces with the Willard Storage Battery Company, Cleveland, Ohio, having resigned his position in the Research Engineering Department of the Westinghouse Electric & Manufacturing Company.

H. E. Randall, Jr., Montreal, Canada, who is in charge of the sales department in an engineering capacity of the Shawinigan Water & Power Company, has been elected a junior member of the Canadian Society of Civil Engineers.

H. M. Byllesby and Samuel Kahn were re-elected president and vice-president respectively, at the annual meeting of the Western States Gas & Electric Company. Allen L. Chickering was re-elected secretary and general counsel.

J. P. Hutcheson has accepted a position on the sales force of the Electrical Engineering & Manufacturing Company, Pittsburgh, Pa. He formerly was connected with the Pittsburgh district office of the Westinghouse Electric & Manufacturing Company.

V. E. Welker has become connected with the Westinghouse Electric & Manufacturing Company's Chicago office and will represent the company in Minneapolis territory. He formerly was chief electrician of the municipal lighting plant of Redfield, S. D., and later superintendent of construction of the Northern Iowa Gas & Electric Company.

Charles Proner, for four years advertising manager of Smith & Hemenway Company, Inc., 130 Coit Street, Irvington, N. J., manufacturers of "Red Devil" tools and hardware specialties, has severed his connection with that firm to accept the position on the staff of the Wales Advertising Company, 110 West 40th Street, New York City. Mr. Proner will continue to handle personally the advertising account of the Smith & Hemenway Company, Inc., as heretofore.

E. C. Gribble has joined his brother W. A. Gribble in the Electrical Specialty Company, San Francisco, Cal.

Lyman P. Hammond, of Bonbright & Company, has been elected a director of the California Railway & Power Company, increasing the directorate to twelve members.

R. J. Hughes, who for nine years has been superintendent of the United Light & Railway Company, Grand Rapids and Mason City, has accepted a position in the Minneapolis (Minn.) office of the Westinghouse Electric & Manufacturing Company.

W. C. Carter has been placed in charge of the sales office at Grand Rapids, Mich., of Westinghouse Electric & Manufacturing Company, for the handling of western Michigan business. This office is under direction of the company's Detroit office.

W. G. Lawrence has opened an office at 472-3 Spitzer Building, Toledo, Ohio, to engage in electrical engineering, and will make a specialty of power plant designing, street lighting, and supervision of construction and electrical installations. One of the associates of Mr. Lawrence is H. A. Seward, who recently came to Toledo from Chicago to join this firm. Mr. Lawrence, also a Chicago engineer, located in Toledo several years ago. This firm would be interested in receiving the catalogues of electrical equipment manufacturers and sales agencies, especially as to power and lighting facilities.

George A. Schneider, formerly power apparatus specialist at the San Francisco office of the Western Electric Company, has assumed charge of the company's office at Buffalo, N. Y. His promotion comes in recognition of valuable services rendered not only to the company he has served so faithfully, but to the electrical industry as a whole. His series of articles contributed to the Journal of Electricity during the last year, under the heading of "Suggestions for Electrical Contractor and Dealer" have been widely read by men of the industry and discussions and interest that followed have been of high order.

Robert E. Dillon has been appointed assistant superintendent of the generating department of the Edison Electric Illuminating Company, Boston, Mass. Mr. Dillon attended various technical schools, among them the Massachusetts Institute of Technology, from which he was graduated with the degree of B. S. in mechanical engineering in 1910. He entered the employ of the Edison Electric Illuminating Company in 1911, being placed in charge of the steam testing division of the standardizing and testing department, and besides routine tests, conducted many special tests. He is a junior member of the A. S. M. E., and a member of the Engineers Club of Boston.

Laurence H. Parkhurst has been elected a vice-president of the Electric Bond & Share Company, of New York City. He formerly was manager of the bond department of the Old Colony Trust Company.

H. R. Frost, formerly treasurer and general auditor of the Northern States Power Company, has been appointed assistant general auditor of H. M. Byllesby & Company, with headquarters at Oklahoma City, Okla.

A. D. Johnson, Cambria representative for the Wisconsin Power, Light & Heat Company, has been appointed division superintendent for the company, with headquarters at Portage, succeeding Superintendent F. M. Nourse, who has accepted a position with an electric company in Chicago.

B. M. Warner, general superintendent of the various Spreckels companies at San Diego, Cal., comprising the San Diego Electric Company, the San Diego & Southeastern Railway and the Point Loma Railroad, has been chosen chairman of the board of economics which has been created to handle important matters pertaining to the operation, maintenance, construction, etc., of the companies. He has been also appointed manager of the Coronado Beach Company, the Coronado Water Company and the United Light, Fuel & Power Company, with jurisdiction over the engineering, hotel power plant, tent city departments and other interests.

Obituary.

Walter Lockitt, vice-president and director of the American District Telegraph Company, Brooklyn, N. Y., died December 3, aged 50 years.

Henry Hyde Whitman, assistant counsel to the Public Service Commission, died November 29, aged 56 years. His home was at 103 East Eighty-sixth Street. He is survived by his widow.

Halsey Ray Hammond, connected with the Western Electric Company, New York, in the capacity of mechanical engineer, died November 28, at the Long Island College Hospital, following an operation for appendicitis. His home was at 256 Jefferson Avenue, Brooklyn.

Willard Hungerford, head electrician of the municipal lighting plant at Madison, S. D., was instantly killed recently while on duty at the plant. He was adjusting a down wire and in some manner a full circuit passed through him. Interment was at Ottumwa, Ia., his old home.

Joseph T. Kean, a member of the Commonwealth Edison Company's application bureau, contract department, since 1912, died at the residence of his sister, Mrs. J. E. Simpson, 508 South Kenilworth Avenue, Oak Park, Ill., November 30. He was 52 years old and single.

Current News

Weekly Record of Construction Activities—Record of Electrical Patents Issued November 27

EASTERN.

SPRINGFIELD, VT.—Colonial Power & Light Company is making rapid progress in increasing the voltage of the transmission line from Cavendish to Claremont from 11,000 to 44,000 volts.

QUINCY, MASS.—Fore River Shipbuilding Company, 97 East Howard street, has awarded a contract for the erection of a power house, one-story, at its plant now in course of construction on Vulcan street, Tonawanda, N. Y. The structure, in connection with another shop building, is to be used for the operation of the works which will be devoted to the manufacture of turbines. The Aberthaw Construction Company, 27 School street, Boston, is the contractor.

HARTFORD, CONN.—Colt's Patent Fire Arms Company, Huyshope avenue, has awarded a contract for the construction of a two-story power house at its plant, about 50x96 feet. The structure will cost $15,000.

NEW YORK, N. Y.—Interborough Rapid Transit Company is supplying the power for the operation of the new Broadway subway, which is under the ownership of the Brooklyn Rapid Transit Company. Under a contract approved by the Public Service Commission the company will continue to furnish power when the line is completed. It will also supply the power necessary for the operation of all of the rapid transit lines in this city controlled by the New York Consolidated Railroad Company and the New York Municipal Railway Corporation, both of which are subsidiaries of the Brooklyn Rapid Transit Company.

SYRACUSE, N. Y.—Board of Education has awarded a contract to the Edward Joy Company, Syracuse, for the installation of a new telephone system in the Delaware school.

JERSEY CITY, N. J.—Board of Freeholders is planning for extensive improvements to modernize the electric lighting plant at Snake Hill. The entire work will involve an expenditure of approximately $150,000, and an appropriation for this amount is being arranged for.

MADISON, N. J.—Council has made application to the Board of Public Utility Commissioners for permission to combine the service of the municipal lighting plant with that of the lighting plant at Chatham for the purpose of conserving fuel. It is planned to have the Chatham plant carry the load from midnight until noon, at which time the load is not so heavy, and the Madison plant to carry the heavier load from noon up to midnight. It is estimated that a fuel saving of approximately 40 per cent would result should this plan be carried out.

MATAWAN, N. J.—Borough Council is planning improvements and extensions in its electric street-lighting system, to include the installation of new lights in Jackson, Monroe and Center streets, and the electrification of the pumping plant at the local waterworks.

NEWARK, N. J.—Board of Education has awarded a contract for the construction of its one-story boiler plant at the Alexander Street school. The structure, which will be about 20x55 feet, is estimated to cost $15,500. The Fred Fatzler Company, 810 Broad street, Newark, is the contractor.

PERTH AMBOY, N. J.—City Council is planning for improvements and extensions in its electric street-lighting system.

ERIE, PA.—Erie Forge Company, Fourteenth and Cascade streets, has awarded a contract for the construction of its proposed one-story power plant and substation, about 90x140 feet. The James R. Gloyd Company, Hippodrome Annex Building, Cleveland, Ohio, has the contract for erection.

HARRISBURG, PA.—City Council is planning for extensions and improvements in its electric street-lighting system in the Riverside district of the city.

HARRISBURG, PA.—Until December 21, the Board of School Directors will receive bids for electrical work in a new school building to be erected on Sixth street. D. D. Hammelbaugh, secretary.

HAZLETON, PA.—Harwood Electric Company has commenced work on the extension of its lines to the plant of the Bethlehem Steel Company. The company will also run its lines from Freeland to the Pond Creek colliery for the operation of the works, and has commenced the erection of the poles for this purpose.

LANCASTER, PA.—Atlas Powder Company is planning for the immediate installation of electric motors for the operation of the powder plant now in course of construction at Reynolds.

LANSDOWNE, PA.—Delaware County Electric Company has filed notice with the Public Service Commission of the issuance of stock to the amount of $2,692,800 to provide for extensions and improvements.

PHILADELPHIA, PA.—H. Belfield Company, 435 North Broad street, has awarded a contract for the erection of a power plant, to be constructed in connection with a large industrial plant. William Steele & Sons Company, 30 South Fifteenth street, Philadelphia, is the contractor.

PHILADELPHIA, PA.—Philadelphia & Reading Railway Company, Reading Terminal, has had plans prepared for the construction of additions to its plant at Norristown, to include a two-story brick signal tower; one-story brick battery house, and new signal bridge. Samuel T. Wagner is engineer for the company.

PHILADELPHIA, PA.—Tacony Ordnance Corporation, Tacony, near Philadelphia, has awarded a contract to Narclay White & Company, 1713 Sansom street, for the erection of a power house at its plant. The structure will be brick, stone and steel, about 45x50 feet, and in connection with another structure will cost $12,000.

PHILADELPHIA, PA.—American International Shipbuilding Corporation has acquired land from the Chester branch of the Philadelphia & Reading Railway, commencing at Alburger Lane, for right-of-way purposes, and is constructing a high tension transmission line to the new Hog Island shipyard for power purposes.

PHILADELPHIA, PA.—The Philadelphia Electric Company has acquired the power house of the Edison Electric Light Company at 904-10 Sansom street. The structure is about 70x100 feet, and the value is estimated at about $180,000.

PITTSBURGH, PA. — Consolidated Traction Company has filed notice of a bond issue for $200,000 to provide for improvements, extensions, etc.

POTTSVILLE, PA.—Scott Haven Light Company, Scott Haven, has had plans prepared for the erection of a one-story power house, about 40x50 feet. W. H. Hill, Pottsville, is the architect.

READING, PA.—Metropolitan Edison Company has announced that effective January 1, all lighting rates would be increased 15 per cent, except where service is supplied for domestic purposes only. The company states that this increase is due to the increased cost of coal, higher-paid labor, and consequent increased cost of operation.

ROARING SPRINGS, PA.—Roaring Springs Light, Heat & Power Company has filed notice of an increase in its capital stock to the amount of $50,000, for improvements, etc.

SCRANTON, PA.—Maccar Truck Company has awarded a contract for the erection of a one-story brick power house, about 28x32 feet. L. T. Stipp, Scranton, is the contractor.

SCRANTON, PA.—Jefferson Electric Company has filed notice of a bond issue of $29,000 to be used for the purpose of acquiring the plant of the Reynoldsville Light & Power Company, Reynoldsville.

WABANK, PA.—Lancaster Electric Light, Heat & Power Company's plant here was destroyed by fire recently, causing a loss of $150,000.

DOVER, DEL.—Miles Smith Corporation has incorporated with a capital of $1,000,000, to operate light, heat and power plants. Incorporators are M. M. Clancy, C. L. Rimlinger, Wilmington, and C. M. Egner, Elkton, Md.

DOVER, DEL.—Cities Fuel & Power Company has incorporated with a capital of $10,000,000, to operate plants for the generation of electricity and manufacture of gas. Incorporators are L. B. Phillips, and J. B. Bailey, Dover.

BALTIMORE, MD.—Chesapeake & Potomac Telephone Company, 5 Light street, has had plans prepared for the construction of a one-story and basement brick telephone exchange plant at Rosslyn, Va. McKenzie, Voorhees & Gmelin, 1123 Broadway, New York, are the architects. The company recently increased its capital from $10,000,000 to $15,000,000.

PETERSBURG, VA.—Petersburg & Appomattox Electric Railroad, Sycamore street, is planning for the construction of a one-story granite block central heating plant at Lakemont, near Petersburg. F. A. Bishop, Petersburg, is architect for the company.

HUNTINGTON, W. VA.—McKinley Storage Battery Company has incorporated with a nominal capital of $5000 to engage in the manufacture of storage batteries. Incorporators are W. R. Power, T. J. McKinley, Huntington, and C. W. Marcum, Ceredo.

PARKTON, N. C.—City is planning for a bond issue for $5000 for the installation of new electric lights in various city streets. F. N. Fisher is mayor.

CHARLESTON, S. C.—Charleston Consolidated Railway & Lighting Company is planning for the construction of a rotary converter substation on Clement's Ferry Road, between Five-Mile House Curve and Oaks curve. The structure will be one-story brick and concrete, and will be used to supply power to the suburban railway. The station will have a capacity of 700 horsepower, and will transform a three-phase alternating current at 13,200 volts into 440 volts, which will be converted by the rotary converter to direct current at 550 volts.

NASHVILLE, GA.—Council is investigating the cost of lighting the public square by electricity.

NORTH CENTRAL STATES.

AKRON, OHIO.—Akron Battery & Electric Company has incorporated with a capital of $2500. W. C. Kimball, E. J. Schultz, E. S. Sheck, O. E. Sellers and N. E. Herwick are the incorporators.

CANTON, OHIO.—Republic Stamping & Enameling Company will shortly complete the installation of its own electric power plant, which will operate its entire factory. Most of the equipment has been ordered.

CINCINNATI, OHIO.—G. A. Electric Manufacturing Company has incorporated with a capital of $10,000. The incorporators are: George R. Adams, Sr., George R. Adams, Jr., Julius H. Schatzman, E. C. Deupre and George Codey.

CLEVELAND, OHIO.—American Steel & Wire Company is now erecting a coke plant on Harvard avenue, which will cost $400,000. The company will use all kinds of unloading machinery and will install from five to seven boilers. Several hoisting and magneto cranes will be required. Address the company's department of engineering, Western Reserve Building, Cleveland.

CLEVELAND, OHIO.—Cleveland Controller & Manufacturing Company has incorporated with a capital of $20,000. L. C. Spieth, L. A. O'Neil, N. M. Strine, M. E. Gleason and M. G. Egan are the incorporators.

CLEVELAND, OHIO.—On account of a controversy between certain officials of the city, county and Cleveland Railway Company, no lighting system has been installed on the lower lever of new high level viaduct, which connects the east and west sides of the city. At a meeting held it was decided the city will have full charge of installing this system, which will consist of about 60 electric street lamps of modern design, also lighting equipment to conform to cost from $15,000 to $18,000.

CLEVELAND, OHIO.—The Physicians and Surgeons Exchange Company, C. H. Salmons, president, 10310 Churchill street, is having plans prepared for a 16-story office building at the corner of Chester avenue and East 13th street to cost $1,000,000 or more. The building will be of steel and reinforced concrete with terra cotta front. It will be designed especially for offices and operating rooms for physicians and surgeons and will require an exceptionally large amount of electrical equipment and wiring. The Allen & Osborne Company, 700 Rose Building, Cleveland, is architect.

CLEVELAND, OHIO. — Prest-O-Lite Company recently suffered a fire loss amounting to $7000. A gas tank for storing gas used in the manufacture of light for automobiles was burned. The new gas tanks will be installed, 15 feet high and 15 feet in circumference.

CLEVELAND, OHIO.—During the coming year the Cleveland Board of Education will erect two new types of school buildings, one a 30-room one-story building; the other a three-story building without corridors and to be adjoined by a separate building for gymnasium, auditorium and swimming pool, and perhaps a separate structure for a power house.

SIDNEY, OHIO.—Citizens of DeGraff have voted to sell their municipal lighting plant to the Sidney Electric Company. The company plans to build a modern transmission line from Sidney through Pemberton, Quincy, and into DeGraff for supplying these towns with 24-hour electric service.

DAYTON, OHIO.—Dayton Electrical Manufacturing Company has incorporated with a capital of $125,000. H. G. Catrow, William V. Knoll, Vincent G. Apple, I. Webb and Earl H. Turner.

CLINTON, IND.—Wabash Valley Electric Company has increased its preferred capital stock from $250,000 to $400,000.

CORYDON, IND.—At a special session of the town board a contract was made with the Interstate Public Service Company whereby the street lighting system is to be greatly improved. It is stipulated that improvements shall be made within six months from this date. It is estimated that improvements will cost between $15,000 and $20,000. Frank Wright is local agent for the company.

FORT WAYNE, IND.—Board of Public Works will enlarge the electric lighting plant and purchase additional machinery. The cost is estimated at about $25,000. Bids for the new structure will be received immediately if the plans are approved.

GARY, IND.—Edison Electric Construction Company has incorporated with a capital of $10,000, to deal in electrical equipment. Stephen Blaner, Clarence Rockey and Charles Martin are the incorporators.

CHICAGO, ILL.—The Chicago, Milwaukee & St. Paul Railroad has divided the contract for locomotives and substation equipment for its Cascade Mountain electrification from Othello, Wash., to Tacoma and Seattle, between the General Electric Company and the Westinghouse Electric & Manufacturing Company. Electrification will be rushed because of the saving in fuel it will effect. The section to be electrified is 211 miles long. This, with the 440 miles already electrically operated over the Belt, Bitter Root and Rocky Mountains, between Avery, Idaho, and Harlowton, Mont., will make a total of 651 miles.

EAST ST. LOUIS, ILL.—Madison County Light & Power Company, a subsidiary of the McKinley System, has increased its capital stock from $335,000 to $500,000.

HILLSBORO, ILL.—Southern Illinois Light & Power Company has filed a petition with the Illinois Public Utilities Commission seeking to increase its rates in Litchfield and Hillsboro, Ill.

MATTOON, ILL.—Central Illinois Public Service Company of Mattoon, and the Canton Gas & Electric Company, of Canton, Ill., have filed a joint petition with the Illinois Public Service Commission asking that the latter company be permitted to run its high tension transmission lines from Ipava to Lewistown, Ill., and for the former company to conduct a transmission line from the West Havana, Ill., substation, across the Illinois River from Havana, Ill., to the southern terminus of the Canton Gas & Electric Company's present line; also for the Canton Gas & Electric Company to construct a transmission line to serve the Liverpool Drainage and Levee District; and finally for the approval of the Commission of an incorporate working agreement between the two companies.

EATON RAPIDS, MICH.—At municipal election recently the proposition to bond the city for $30,000 to buy the Smithville water power carried.

MONROE, MICH.—Detroit Edison Company has 25-year franchise for furnishing current to Monroe. The old municipal lighting plant will be dismantled and the property turned over to the city.

BEAVER DAM, WIS.—Preparations are being made by the local electric company to use current from power plants on Wisconsin River, as soon as the line is completed as far as the city.

CLINTONVILLE, WIS.—Plans are in progress for two hydroelectric power plants near here. Owner, Topp-Stewart Tractor Company.

DENMARK, WIS.—Preparations are being made by the Denmark Condensed Milk Company for a power plant. Bids will soon be taken.

MANITOWOC, WIS.—A franchise has been granted to the Wisconsin Public Service Company, of Green Bay, for an electric lighting system. C. R. Phenicie, general manager, Green Bay.

OSHKOSH, WIS.—Petition has been presented to council, asking for electric lights on Broad street.

THORP, WIS.—City is considering buying from the Wisconsin-Minnesota Light & Power Company, of Eau Claire, the power plant operated here.

WAUSAU, WIS.—Wisconsin Valley Electric Company will expend $100,000 in improvements. Address M. C. Ewing, general manager.

ST. PAUL, MINN.—City officials will submit plans to the Government for the following work: To extend harbor line 1000 feet, build sea walls from Omaha bridge to Indian mounds; also docks and wharves (including cold storage), municipal belt line and first unit of municipal power plant. Preliminary plans were made by the City Engineer, Oscar L. Claussen. Estimated cost is $1,000,000.

WABASHA, MINN.—R. E. Jones & Company, supplying power and lighting service, will probably remove surface wires and install underground conduits in downtown district. Address R. A. Leistikow, city clerk.

RIVERSIDE, IA.—Electric power is now supplied to this place by the Iowa Railway & Light Company, of Cedar Rapids. A number of homes and business houses have been wired and many other jobs are awaiting the wiring crews.

WELLMAN, IA.—Wellman Light & Power Company's plant has been acquired by G. S. Carson, of Washington, Ia., who owns the plant there and furnishes power for West Chester and other neighboring towns.

OZARK, MO.—Finley Light Company has been incorporated under Missouri law to operate a mutual electric light plant. John C. Rogers, George T. Breazeale and D. W. Bingham are the incorporators.

PLEASANT HILL, MO.—Green Light & Power Company has incorporated with a capital of $150,000. The incorporators are L. K. Green, L. R. Green and others.

ST. LOUIS, MO.—Union Electric Light & Power Company has made application to the Public Service Commission to increase its lighting and heating rates, due to increased operating costs.

ESMOND, S. D.—Preparations are being made to install electric lighting system.

FAITH, S. D.—City contemplates installing electric lighting plant.

LEITH, N. D.—Machinery and other equipment has been received for the new electric plant. The plant is of sufficient size to care for the normal development of this growing town for a number of years to come.

SOUTH CENTRAL STATES.

WHITESBURG, KY.—W. C. Daniels & Sons are planning for improvements and extensions in their electric-lighting plant.

MEMPHIS, TENN.—Yazoo & Mississippi Valley Railroad has increased its capital stock from $15,000,000 to $21,553,300 and plans to double track the line from Memphis to Vicksburg, about 190 miles. Work to be done at the rate of 20 miles a year. Address A. H. Egan, Memphis.

MOBILE, ALA.—Chickashaw Shipbuilding Company is planning for the construction of an electric-lighting and railway system for the plant employes' town.

KENNER, LA.—About $10,000 will be expended to provide electric lighting.

TULSA, OKLA.—Domestic Electric Lighting Company, 206 Gillette Building, has incorporated with a capital of $5000. The incorporators are R. E. Evans and others.

DALLAS, TEX.—Dallas Power & Light Company has increased its capital stock from $150,000 to $2,000,000. This increase of capital stock is all paid in. The amendment states that the holdings of the company have a value of $5,850,000 and consist of a plant of 17,000 kilowatts capacity, more than 365 miles of power transmission lines and more than 24,000 connections with customers. The Dallas Railway Company, which is owned by the same interests as the Dallas Power & Light Company, has also filed an amendment to its charter in the secretary of state's office at Austin, increasing its capital stock from $100,000 to $2,650,000. This company has taken over the holdings of the Dallas Consolidated Electric Street Railway Company, the Metropolitan Street Railway Company, the Dallas Equipment Company, the Rapid Transit

DATES AHEAD.

American Institute of Consulting Engineers, Inc. Annual meeting, January 14. Secretary, F. A. Molitor, 35 Nassau Street, New York City.

Electrical Contractors' Association of State of Missouri. Annual convention, January 19. Secretary, A. J. Burns, 318 West Tenth Street, Kansas City, Mo.

Minnesota Electrical Contractors' Association. Annual convention, Minneapolis, Minn., January 20. Secretary, G. M. Jones, 112 South Seventh Street, Minneapolis.

Western Association of Electrical Inspectors. Annual meeting, Memphis, Tenn., January 29-30-31. Secretary, W. S. Boyd, 175 West Jackson Boulevard, Chicago, Ill.

Illinois Electrical Contractors' Association. Semi-annual convention, Chicago, February, 1918. Secretary-Treasurer, L. B. Van Nuys, 238 South Jefferson Avenue, Peoria, Ill.

Vermont Electrical Association. Annual meeting, February, 1918. Secretary-Treasurer, C. H. West, Rutland, Vt.

National Association of Electrical Inspectors. Annual convention, New York, March, 1918. Secretary-Treasurer, William L. Smith, Concord, Mass.

Wisconsin Electrical Association. Annual meeting, March, 1918. Secretary, George Allison, 1410 First National Bank Building, Milwaukee, Wis.

Southwestern Society of Engineers. Annual meeting, April, 1918. Secretary, C. E. Barglebaugh, 703 First National Bank Building, El Paso, Tex.

Kentucky Association of Electrical Contractors. Annual meeting, May, 1918, Louisville, Ky. Secretary, F. F. Valinoti.

Texas State Association of Electrical Contractors. Annual meeting, Galveston, Tex., June 15, 1918. Secretary, H. S. Ashley, Fort Worth, Tex.

Georgia Electrical Contractors' Association. Annual meeting, June, 1918, Tybee Island, Ga. Secretary, Dan Carey, Atlanta Builders' Exchange, Atlanta, Ga.

Railway Company and the Dallas Interurban Terminal Association, having a total value of $6,000,000. The increases of capital of both of the new companies were paid in by Harry M. Downing, of New York, representing the owners.

WESTERN STATES.

KALISPELL, MONT.—An ornamental lighting system to cost about $14,500 is under consideration by the city. R. E. Rollins, city clerk.

HAILEY, IDA.—City has voted down the proposition to issue bonds in the sum of $100,000 for installing electric lights, power and water systems.

CATHLAMET, WASH.—William Lund has installed an electric light and power plant on his dairy farm. The dwelling has been equipped with electric lights and all machinery about the place requiring power has been connected with motors.

SEATTLE, WASH.—City council has appropriated $38,200 for the second section of the northerly extension of Division A of the municipal line from Market and Leary streets to the intersection of the Loyal Heights line at 23rd avenue Northwest and West 67th street; $22,000 for the double tracking of the municipal line on Nickerson street, and $2500 for grading and graveling of Nickerson street where it would be torn up by the construction work.

SEATTLE, WASH.—Electric Manufacturers Agency, Inc., is the name of a new concern recently incorporated here, under the laws of Washington. This concern succeeds H. G. Dehneman, Inc., manufacturers' agents, taking over the entire business of the old company, including all of its assets and liabilities. The address will be the same as that of the old firm, 617 Fourth avenue, Seattle, where the warehouse and main offices will be located. Electrical specialties for all installations as well as glassware for all illuminations will be carried. Officers are Joseph Schoemer, president and manager; George Buckman, vice-president, and Walter Funfsinn, secretary-treasurer. The territory covered includes Washington, Oregon, Idaho, Montana and British Columbia.

SEATTLE, WASH.—Ferris & Hardgrove announce a $390,000 bond issue of the city for light extension. The price is par, interest to yield five per cent. Liberty bonds of both the 3½ per cent issue and the 4 per cent are selling a little below par and will be accepted at par in the purchase of the Seattle bonds. Seattle has contracted and agreed to maintain such rates and charges from its municipal light and power system, now serving over 45,000 customers, sufficient at all times to take care of the payment of principal and interest on these bonds. Advance orders have been listed for $150,000 of the issue and a ready sale for the balance has been anticipated. The bonds mature in $25,000 lots, annually, over a period from Oct. 1, 1923, to Oct. 1, 1937, and are ready for delivery now.

TACOMA, WASH.—City council is considering the different power sites that have been made to the city, in view of the fact that it is necessary to acquire more electrical energy at the earliest possible moment. F. K. Owens, owner of a power site on the Stillaguamish river near Everett, Wash., recently made an offer to sell to the city for $4,000,000.

OROVILLE, CAL.—Great Western Power Company has bought 1225 acres lying north of the Feather river, on which the company plans to construct a plant at a cost of $6,000,000.

SAN FRANCISCO, CAL.—California Railroad Commission has authorized the Great Western Power Company to operate in the town of Taylorville and certain other portions of Plumas County.

VENTURA, CAL.—Sealed bids have been called for by this city for the installation of 52 ornamental street lights in street lighting district No. 1, as per plans and specifications on file.

WATSONVILLE, CAL.—Board of Aldermen has instructed the city attorney to take up the question of buying the gas and electric plant of the Coast Counties Gas & Electric Company. A report will be made later.

PROPOSALS

FIRE ALARM SYSTEM.—Navy Department, Office of the Chief of Bureau of Yards and Docks, Washington, D. C., will receive sealed proposals December 17 for installing fire alarm system in the naval hospital at Great Lakes, Ill.

HIGH SCHOOL WIRING.—Bids will be received December 19 on electric wiring for a high school annex to be built at Kenmore, Ohio, at an estimated cost of $125,000. M. P. Lauer, Peoples Saving & Trust Building, Kenmore, is the architect.

ELECTRICAL EQUIPMENT. — Until December 20, the Commission on New Prisons, Room 618, Hall of Records Building, Center and Chambers streets, New York City, will receive bids for electrical work for cell house, interlocking building, mess hall, central heating and lighting plant, underground conduit work, and underground electric service connections at the Wingdale Prison, Wingdale, N. Y. Lewis F. Pilcher, State Architect, Capitol, Albany.

AIR COMPRESSOR AND MOTORS.—Sealed bids will be received December 17 by Phil Peck, Joliet, Ill., for furnishing f. o. b. Joliet, one air compressor for the pumping plant at Ottawa street, together with a motor for running the same and a motor for driving the Triplex pump at said plant. The successful bidder will be required to furnish an erecting engineer and Joliet will furnish all labor necessary for erecting said machinery on foundations to be furnished by Joliet.

INCORPORATIONS

NEW YORK, N. Y.—Leslie-Stevens Company. Capital, $10,000. To engage in the manufacture of general engineering and electrical supplies. Incorporators: C. H. Stevens, E. A. Leslie, and W. P. Faendler, Brooklyn.

BROOKLYN, N. Y.—M. J. Wohl Company. Capital, $30,000. To manufacture electrical specialties. Incorporators: M. J. Wohl, and M. and B. Mayer, 849 Beck street, New York.

RALEIGH, IA. — Raleigh Telephone Company. Capital, $7000. Incorporators: Ed. E. Swanson, of Estherville, Ia., and others.

FOREIGN TRADE OPPORTUNTIES

A merchant in Italy is in the market for electric wire for internal installations, cotton coated, with a capacity of 350 volts; black and white insulating tape 1 and 2 centimeters wide; porcelain insulators; electric-lamp bulbs with wire-drawn filaments, with a voltage of 120, 125 and 200, candlepower ranging from 5 to 50; crystal and porcelain reflectors and other fittings for electrical installations; all kinds of electric fans; electric motors; and cotton-coated wire for electric bells. Quotations should be made f. o. b. New York City. Payment will be made by opening credit in local bank, available against shipping documents. Correspondence should be in French and references are required. For more information relating to this item address Bureau of Foreign and Domestic Commerce, Room 307 Custom House Building, San Francisco, Cal., referring to opportunity No. 25814, file No. 91565.

An agency is desired by an association in Switzerland for the sale of merchandise in general, especially chemicals, electrical appliances, motor trucks, motor-driven farm tractors, railroad supplies, rubber goods, typewriters, etc. Quotations may be made f. o. b. New York City. Account will be opened in New York bank for payment. Correspondence may be in English and references are required. For more detailed information address Bureau of Foreign and Domestic Commerce, Room 307 Custom House Building, San Francisco, Cal., referring to opportunity No. 25804.

Electrical Patents Issued November 27, 1917

Prepared by Thomas Howe, Patent Attorney, 2 Rector Street, New York, N. Y.

1,247,613. **Electric Meter.** J. L. Axen, Detroit, Mich. Current indicator especially adapted to prevent reversal of the magnet.

1,247,623. **Air-Dispensing Means.** S. D. Black and A. G. Decker, assignors to Black & Decker Mfg. Co., Baltimore, Md. Switch controlling air compressor for tire inflater is operatively related to knob of door to compressor casing.

1,247,649. **Electric Starting and Lighting System for Motor Vehicles.** A. E. Doman, assignor to Dyneto Electric Corp., Syracuse, N. Y. Arrangement of storage battery and motor-generator set.

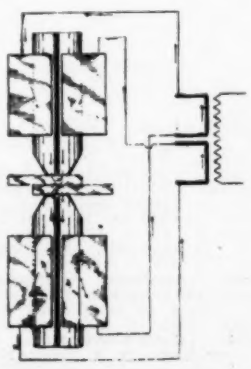
1,247,650. **Motor-Generator.** A. E. Doman, assignor to Dyneto Electric Corp. Casing for machines comprising two axially compressed steel tubes.

1,247,653. **Door-Guard.** T. Farmer, Jr., assignor to Consolidated Car-Heating Co., Albany, N. Y. Door attachment for controlling door-operating motor.

1,247,656. **Terminal for Conductors.** W. Gadke, Philadelphia, Pa. Structure of plug and socket connector.

1,247,660. **Swivel-Contact for Electrical Conductors.** F. Garrison, St. Louis, Mo. Details of construction.

1,247,669. **Telephone-Exchange System.** C. L. Goodrum, assignor to Western Electric Co. Arrangement of selector switches and connections in automatic system.



No. 1,247,741.—Electric Spot Welder.

1,247,672. **Telephone Conductor.** C. W. Hallberg, Chicago, Ill. Arrangement of cords and reel therefor for establishing connections to a portable desk telephone.

1,247,676. **Fire-Alarm Signaling Apparatus.** C. A. Harsch, assignor to W. H. Garrison, Brooklyn, N. Y. Has a series of motor-operated signal transmitters of different characteristics at a single station.

1,247,690. **Electric Switch.** C. J. Klein, assignor to Cutler-Hammer Mfg. Co., Milwaukee, Wis. Two push-button, flush switch.

1,247,694. **Electrolytic Apparatus.** I. H. Levin, Newark, N. J. Arrangement comprising a number of bipolar electrodes and special gas-venting construction.

1,247,737. **Recorder.** E. Stout, Oskaloosa, and W. Haist, Burlington, Iowa. Structure having electromagnetically controlled vibrator carrying a marker.

1,247,741. **Electric Welding Apparatus.** A. C. Taylor, Warren, Ohio. Spot welder with electrodes arranged to pass separate currents on bias intersecting lines through the work. (See cut.)

1,247,751. **Switch.** J. A. Van Alstyne, assignor one-half to C. V. Schneider, Sacramento, Cal. Inclosed switch and fuse combination electromagnetically controlled.

1,247,753. Table-Lever for Electric Signaling Apparatus. E. W. Vogel, assignor to Chicago Railway Signal & Supply Co., Carpentersville, Ill. For controlling signal apparatus having two separate circuits.

1,247,756. Conduit for Electric Wires. F. L. O. Wadsworth, assignor to Enameled Metals Co., Sharpsburg, Pa. Device for protecting the threads on a conduit or pipe.

1,247,759. Rectifier. A. Wehmeier, St. Louis, Mo., assignor to Fore Electrical Mfg. Co. Vibratory switch and circuits.

1,247,770 and 1,247,771. Automatic Telephone System. S. B. Williams, Jr., assignor to Western Electric Co. Manner of grouping lines, switches, etc.

1,247,793. Starting and Generating System for Automobiles. A. Churchward, assignor to A-B-C Starter Co., Detroit, Mich. Relates to gearing of the motor.

1,247,796. Telephone Switch. W. W. Dean, assignor to Stromberg-Carlson Telephone Mfg. Co., Rochester, N. Y. Transmitter circuit switch for operation by receiver hook.

1,247,800. Electrode Grip-Handle. W. H. Earnest, Meadville, Pa. For a welding implement.

1,247,816. Combined Spark-Plug Primer, Compression-Indicator, and Pressure Gauge. M. O. Georgin, Factoryville, Pa. Structural details.

1,247,820. Electric Socket. D. D. Gordon, assignor to Yost Electric Mfg. Co., Toledo, O. Details of construction.

1,247,825. Moisture and Gasproof Telephone Case. C. E. Hague, assignor to Stromberg-Carlson Telephone Mfg. Co. For mine telephone.

1,247,831. Telephone System. H. L. Harris, assignor to Stromberg-Carlson Telephone Mfg. Co. Arrangement of manual exchange.

1,247,842. Switch Mechanism. B. G. Jamieson, assignor one-half to H. J. Richardson, Chicago, Ill. Structure of high-tension oil switch with indicator.

1,247,849. Rotary Electric Brush. D. L. Lowery, Sandusky, O. Structure of motor-operated cleaning brush.

1,247,874. Electrical Display Device. J. S. Pennefather, assignor to Chase Shawmut Co., Newburyport, Mass. Mounting and enclosing casings for incandescent lamps grouped as for an electric flag.

1,247,887. Telephone System. F. M. Slough, assignor to Stromberg-Carlson Telephone Mfg. Co. Manual exchange.

1,247,902. Electromagnetic Controlling Device for Camera-Shutters. K. W. Thalhammer, Los Angeles, Cal. Detailed arrangement of parts.

1,247,907. Flatiron. F. W. Tully, Brookline, Mass. Is counterweighted to remove iron from work when handle is released.

1,247,915. Automatic Safety-Signal System. M. Weil, New York, N. Y., assignor to Safety Railway Control Co. Current through a responsive device on a train has its polarity reversed according to track conditions by a wheatstone bridge arrangement.

1,247,916. Connection Terminal. A. H. Weiss, assignor to Kellogg Switchboard & Supply Co., Chicago, Ill. Details of construction.

1,247,940. Telegraphy. P. B. Delany, South Orange, N. J. Structure of receiver.

1,247,946. Automatic Switch. E. M. Fitz, Worthington, O. Mechanism for causing a double-pole, double-throw switch mounted on field of dynamoelectric machine to be thrown in one direction or other according to rotation of armature. (See cut.)

1,247,947. Trolley Fork. P. Flood, assignor of one-half to E. J. B. Murray, Albany, N. Y. Structural details.

1,247,956. Incandescent Electric Lamp. C. A. Harrison, London, England. Manner of connecting leading-in wires.

1,247,968. Trolley. R. C. Kissinger, Dayton, O. Mounting of wheel shaft in harp.

1,247,975. Spark Plug. W. J. Linn, Fittsburgh, Pa. Structural details.

1,247,976. Line-Finder System. A. E. Lundell, assignor to Western Electric Co. For telephone systems.

1,247,978. Spark Plug. L. A. McDowell, Luverne, Minn. Structural details.

1,247,981. Indicator. G. F. McLaughlin, San Francisco, Cal. Gearing and contact arrangement for electromagnetically controlled structure.

1,247,992. Electric Gasifier for Internal-Combustion Engines. W. D. Nickum, assignor to J. C. Lewis, Portland, Ore. Has an electric heater in passage between carbureter and engine.

1,248,021. Automatic Switch. W. Scribner, assignor to E. M. Fitz, Worthington, O. Modification of No. 1,247,946.

1,248,046. Spark Plug. E. Q. Williams, Syracuse, N. Y. Structural details.

1,248,069. Electric-Light Bulb and the Fittings Therein. D. R. Baity, Melbourne, Victoria, Australia. Bulb is detachable from base.

1,248,074. Combined Switchboard and Rheostat for Controlling the Charging of Electric Storage Batteries. W. C. Carr, Buffalo, N. Y. Detailed arrangement of automatic control panel.

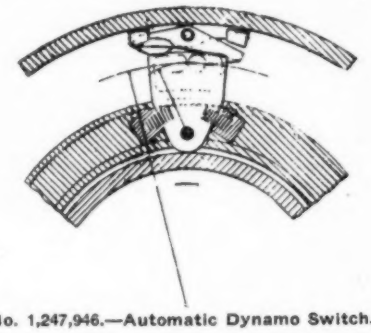
1,248,084. Magnetic Apparatus. K. L. Curtis, assignor to Anderson Mfg. Co., Boston, Mass. Tripping mechanism for a circuit-breaker.

1,248,090 and 1,248,091. Fuse. L. W. Downes and R. C. Patton, assignors to D. & W. Fuse Co., Providence, R. I. First patent: Oil immersed, compound subway fuse. Second patent: inclosed cartridge type.

1,248,093. Automatic Railroad-Gate. J. W. Ebert, Winona, Minn. Control circuits for gate-operating motor.

1,248,103. Lamp Mounting. C. E. Godley, assignor to Edmunds & Jones Corp., Detroit, Mich. For automobile spotlights.

1,248,122. Electric Soldering-Iron. W. F. Hosford, assignor to Western Electric Co. Structure of heating unit.



No. 1,247,946.—Automatic Dynamo Switch.

1,248,130. Electrically Operated Speed-Limiting Device for Motor Vehicles. H. M. Kammerhoff, Orange, N. J. Fuel throttle is controlled by circuit of dynamo driven at speed proportional to engine.

1,248,135. Lamp Socket. C. J. Klein, assignor to Cutler-Hammer Mfg. Co., Milwaukee, Wis. Manner of connecting cap and shell.

1,248,146. Automobile Headlight. B. T. Merrill, Alderton, Wash. Structure having main and supplemental light sources.

1,248,158. Telephone Receiver. A. Poloumordvinoff, Petrograd, Russia. Has the diaphragm specially connected to a vibrating, polarized armature.

1,248,159. Telegraph Apparatus. E. Pope, Quebec, Canada. Structure of controlling tape.

1,248,161. Electric Fixture. R. W. Purcell, St. Paul, Minn. Mounting and connections of pilot lamp.

1,248,176. Alternating-Current Magnet and the Like. H. A. Sedgwick, assignor to Cutler-Hammer Mfg. Co. Structure in which chattering of armature is curtailed.

1,248,177. Signal. G. P. Seiler, assignor one-half to W. R. Blenman, Detroit, Mich. Details of exhibitor.

1,248,187. Lighting Fixture. E. M. Smith, assignor one-half each to L. Plaut and H. Plaut, New York, N. Y. Mounting of reflector and lamp-inclosing bowl; for ceiling attachment.

1,248,188. Automobile Signal. T. M. Smith, Baltimore, Md. Circuits and lamp mounted on driver's arm.

1,248,191. Automatic Lamp-Turner. A. J. F. Snowden, assignor one-half to F. Shideler, Huntington, Ind. Car headlight is turned one way or other by position of trolley pole.

1,248,202. Electrical Receptacle. G. B. Thomas, assignor to Bryant Electric Co., Bridgeport, Conn. Structure of molding receptacle.

1,248,203. Electric Switch. G. B. Thomas, assignor to Bryant Electric Co. Three-point structure.

1,248,210. Igniter for Internal-Combustion Engines. W. C. Vogenbergen, Wilkinsburg, Pa. Make-and-break type.

1,248,219. Igniter for Internal-Combustion Engines. E. G. Wayman, assignor to W. C. Vogenberger. Modification of above.

1,248,222. Insulated Reflector. W. Weckesser, Philadelphia, Pa. Metal reflector mounted on lamp plug by insulating disk.

1,248,246. Circuit-Indicator. W. E. Beede, New York, N. Y. For indicating "charge," "discharge" and "off" conditions in a storage battery circuit.

1,248,255. Relating to Alternating-Current Dynamos. M. Breslauer, Hoppengarten, near Berlin, Germany. Details of field and armature structure and windings.

1,248,260. Meter Protective Device. J. F. Burns, Philadelphia, Pa. Interlocking coverings for cut-out box and meter terminals.

1,248,270. Game Apparatus. T. W. Cooper, New York, N. Y. Details of device, comprising a magnetically attracted ball in a rotating bowl.

1,248,272. Electrical Connector. S. G. Crane, assignor to Toledo Scale Co., Toledo, O. Structure of connection block.

1,248,273. Electric Automatic Scale. S. G. Crane, assignor to Toledo Scale Co. The poise is moved along the beam by a solenoid.

1,248,276. Machine Tool. F. J. Curtis, assignor to Pittsburgh Machine Tool Co., Braddock, N. J. The chips are removed by an electromagnetic arrangement.

1,248,375. Automobile-Light-Circuit Controller. B. A. Morrison and J. H. Duis, Flanagan, Ill. Lights are controlled by the throttle-controlling means.

1,248,380. Method of and Apparatus for Detecting the Presence of Ore Deposits in the Earth. R. Nelson, San Francisco, Cal. The effects on an electrometer when electrodes of different materials are inserted in the earth are noted.

1,248,384. Electric Wall Switch. W. J. Newton and M. Goldberg, assignors to Newton Mfg. Co., Lynbrook, N. Y. Relates to manner of mounting operating lever of toggle switch.

Patents Expired.

The following United States electrical patents expired on December 11, 1917:

663,412. Telephone System. W. W. Bennett, Mesquite, Tex.

663,420. Arc-light Hanger. G. Cutter, Chicago, Ill.

663,454. Electric Arc Lamp. F. W. Martin and F. Stewart, Hamilton, Canada.

663,460. Telegraph Repeater. C. D. Olsen and T. W. Carroll, Denver, Colo.

663,461. Maximum-demand Meter. E. Oxley, Lynn, Mass.

663,465. Program Clock. K. Puttkammer and F. Orthmann, Charlottenburg, Germany.

663,466. Workman's Time Check. K. Puttkammer and F. Orthmann, Charlottenburg, Germany.

663,467. Process of Producing Electric Arc Lights. E. Rasch, Nuremberg, Germany.

663,489. Electrical Connection. W. B. Cleveland, Cleveland, O.

663,490. Method of Forming Electrical Connections. W. B. Cleveland, Cleveland, O.

663,491. Controller for Electric Motors. C. A. Dresser, Chicago, Ill.

663,496. Electric Switch. E. M. Hewlett, Schenectady, N. Y.

663,510. Telephone Switchboard. W. S. Paca, Erie, Pa.

663,511. Telephone Switchboard Apparatus. W. A. Paca, Erie, Pa.

663,519. Electric Rail Brake. R. W. M. Schiemann, Dresden, Germany.

663,524. Incandescent Lamp. S. D. Washburn, Boston, and C. H. Tinkham, Cambridge, Mass.

663,528. Electrically Operated Clip for Tentering Machines. W. Whiteley and W. Whiteley, Jr., Huddersfield, England.

663,532. Flexible Supporting Structure for Electric Lamps. W. F. Brewster, New York, N. Y.

663,600. Electric Railway. T. P. Chandler, Philadelphia, Pa.

663,609. Dynamo or Motor. G. L. Martin, New York, N. Y.

663,625. System of Electric Traction. M. T. de Felice, Rome, Italy.

663,659. System of Electrical Distribution. H. R. Kent, New York, N. Y.

663,695. Electrical Interrupter. J. M. Davidson, London, England.

663,698. Electric Arc Lamp. J. H. Hallberg, Peabody, Mass.

663,719. Electrolytic Apparatus. H. Becker, Paris, France.

663,740. Trolley for Electric Cars. W. H. Earl, Painesville, O.

663,750. Electric Contact or Current-taking Device. E. Greil and E. Audiger, Paris, France.

663,764. Magnetic Separator. E. Kreuser and H. E. Langguth, Mechernich, Germany.

663,781. Circuit-breaker. G. W. Parsons, La Grange, Ill.

663,783. Selective Signal System. F. A. Pickernell, Newark, N. J.

663,788. Trolley Pole. W. Schroeter and A. Kautzmann, Dallas, Tex.

663,798. Igniter for Explosive Engines. G. A. Tuerk, Chicago, Ill.

Financial News

GENERAL CONDITIONS.

First National Bank of Boston in a recent letter reviews general conditions as follows:

The general feeling of optimism as to the military situation, based on repeated successes on the Western Front, has been dampened by the chaotic Russian position and the Italian retreat. Prophecies of an early peace have fortunately vanished, and the country, sobered by the news of our first casualty list, is taking up with renewed spirit, preparations for a long war. The New York stock market, practically the only free and unrestricted exchange in the world, has suffered a severe decline. As the situation crystallizes, certain things are becoming more clear. The Government's price-fixing and industry-regulating policy is becoming effective and calls for many readjustments. With rising costs of doing business, and with the labor problem looming up, business men are taking a very conservative course. On the one hand, those engaged in Government work are speeding up their plants to maximum production, and on the other, civilian business is preceptibly less active. The condition is sound from a point of view of failure, and profits are large. Nevertheless in a few weeks the policy of the Government and the people toward the manufacture of so-called "non-essential products" will be developed, and the possibility that the production of luxuries may be sharply curtailed adds an additional element of uncertainty requiring conservative action on the part of such manufacturers. The amount of business actually being transacted in the country today is enormous, restricted only by the supply of labor, and the outstanding feature of the month is the very rapid increase in the volume of war work and the corresponding waning of civilian production.

Francis H. Sisson, vice-president of the Guaranty Trust Company of New York, in an address recently before the Buffalo Association of Credit Men, regarding securities said:

The criticism which has been made of bankers of New York in regard to the falling stock market certainly is not just in view of the facts, as revealed by investigation. It is not within the power of the bankers of New York to change the economic situation which has been brought about by the war, to which the fall in prices of securities is almost entirely due. The experience we are having in the security market in this country is exactly parallel to that through which England and France have passed and are now passing; and the fall of security values here has not been relatively as great as in other countries. There are various elements in the situation which contribute to this fact. In the first place, the absorption of public funds in government loans necessarily makes it impossible for private offerings to compete. Not only has it been impossible to care for the normal liquidation of securities but the unusual liquidation precipitated by the constriction of the borrowing market has had the inevitable result of falling prices.

BANK EARNINGS.

The Comptroller of the Currency authorizes the following:

Reports just compiled by this office show that the total earnings of the national banks of the United States for the last fiscal year, ending June 30, 1917, were the greatest in their history, and amounted to $667,406,000—an increase of $76,764,000, or 13 per cent, over the previous year. The net earnings of these banks for the same fiscal year amounted to $194,321,000—an increase over the preceding year of $36,778,000, or 23 per cent. On their capital stock the banks report net earnings for the year of 17.96 per cent, the highest percentage ever reported. This compares with 14.78 per cent on stock the year before. The amount distributed in dividends to stockholders was $125,538,000, an increase over the previous year of $10,813,000, or 9.4 per cent. The sum thus distributed was 11.61 per cent on their capital stock, and compares with 10.76 per cent the year preceding. The percentage of net earnings to capital and surplus for the past year was 10.52 per cent, the greatest shown in over 40 years, or since 1873. The percentage of losses to depositors from national banks which failed during this same year was only three-thousandths of 1 per cent of total deposits, which compares with an average for the preceding 35 years of over 24 one-thousandths of 1 per cent.

The issue of $10,000,000 two-year, 7 per cent notes of the Cities Fuel & Power Company, a City Service subsidiary, is to be secured by deposit of securities of City Service subsidiaries having no bonded indtebtedness. A syndicate being formed by Montgomery & Company will place on the market between $2,500,000 and $7,500,000 of these notes, the proceeds of which will be used to increase the output of oil.

COPPER CENSUS.

Department of Commerce, Bureau of the Census, Washington, D. C., has issued a census on 1914 brass, bronze and copper production. The copper statistics follow:

Establishments Manufacturing Principally Copper.

Number of establishments	41
Persons engaged	5,666
Proprietors and firm members	33
Salaried employees	586
Wage earners (average number)	5,047
Primary horsepower	29,066
Capital	$14,966,130
Salaries and wages	3,817,892
Salaries	873,505
Wages	2,944,387
Paid for contract work	7,412
Rent and taxes (including internal revenue)	170,475
Cost of materials	25,317,240
Value of products	30,722,895
Value added by manufacturer (value of products less cost of materials)	5,405,655

In addition to the value of copper products, $30,722,895, there was manufactured by establishments engaged primarily in other industries in 1914, copper valued at $52,118,351.

COPPER DIVIDENDS.

During the first eleven months of 1917 there was paid in dividends to holders of copper shares approximately $161,000,000 which exceeded the total for the entire previous year, the 1916 disbursements having totaled $157,000,000. Anaconda Copper Mining Company leads the list with $19,815,625 against $16,318,750 last year. Utah Copper Company was second, with $17,869,390, while Kennecott Copper Corporation was third, with $13,054,616. In this connection it should be stated, however, that whereas the total for Anaconda represents four quarterly payments neither Kennecott nor Utah has yet declared its fourth quarter dividend, which will put Utah in the lead. The greatest "per share" distribution during the eleven months was made by Calumet & Hecla Mining Company, which disbursed $75 per share. Second in line was Champion Copper Company, owned jointly by Copper Range Consolidated Company and St. Mary's Land Company, which distributed $44.80 per share.

ELECTRIC BOND & SHARE COMPANY

Earnings of subsidiaries of Electric Bond & Share Company compare as follows:

Carolina Power & Light Company.	1917	1916
October gross	$ 86,187	$ 78,936
Net after taxes	26,445	28,553
Surplus after charges	13,265	14,586
Twelve months' gross	894,122	774,635
Net after taxes	321,972	283,913
Total income	450,790	360,463
Surplus after charges	280,012	191,324
Asheville Power & Light Company.		
October gross	$ 41,697	$ 39,734
Net after tax	15,568	14,072
Surplus after charges	10,807	9,731
Twelve months' gross	496,522	450,795
Net after tax	216,000	186,548
Surplus after charges	161,194	136,194
Yadkin River Power Company.		
October gross	$ 39,270	$ 42,904
Net after tax	15,568	14,072
Surplus after charges	10,807	9,731
Twelve months' gross	496,522	450,795
Net after tax	216,000	186,548
Surplus after charges	161,194	136,194

Earnings of the Portland Railway, Light & Power Company for October failed to show a satisfactory margin toward meeting the increased wage schedules for the employees, effective the middle of the month, although new economies and some slight means for increasing revenues were inaugurated the first of last month. Gross earnings increased $62,574 over October of last year, but the operating expenses were $83,577 greater. Gross earnings for October, 1917, were $522,294, operating expenses $292,298; October, 1916, gross earnings were $459,720, operating expenses $208,721.

Net earnings of the Pacific Power & Light Company, Portland, Ore., continue of show gains. For October they showed a gain of 32 per cent and for the past year 16 per cent. Owing to the satisfactory condition of the company's affairs, it has been determined to offer to the public at once $200,000 of the unissued 7 per cent cumulative preferred stock, the proceeds for taking up short term six per cent notes sold for improvements and extensions. For the month of October the gross earnings were $151,310; operating expenses, $73,118. Gross earnings for 12 months were $1,608,309, operating expenses $832,591.

REPUBLIC RAILWAY & LIGHT COMPANY

	1917	1916
October gross	$ 452,968	$ 338,613
Net after taxes	136,702	149,691
Total income	143,132	150,844
Surplus after charges	55,617	81,773
Balance after preferred dividends	29,660	55,816
Twelve months' gross	4,650,883	3,879,282
Net after taxes	1,578,605	1,636,529
Total income	1,633,259	1,652,680
Surplus after charges	657,206	849,772
Balance after preferred dividends	345,722	538,238

NORTHERN STATES POWER COMPANY

	Gross	Operating Expenses	Net
October, 1917	$ 644,547	$ 364,218	$ 280,329
Twelve Months	6,955,250	3,441,045	3,514,205
October, 1916	546,489	234,419	312,070
Twelve Months	5,907,764	2,632,377	3,275,387

TWIN CITY RAPID TRANSIT COMPANY

	1917	1916
October gross	$ 805,687	$ 846,915
Net earnings	213,616	334,019
Surplus after tax and charges	43,499	192,136
Ten months' gross	8,537,793	8,441,904
Net earnings	2,840,862	3,236,231
Surplus after tax and charges	1,314,030	1,801,353

UNITED LIGHT AND RAILWAY COMPANY

Earnings and subsidiaries for 12 months ended October 31, compare as follows:

	1917	1916
Gross earnings	$7,430,516	$6,793,886
Net after tax	2,762,015	2,677,202
Surplus after charges and dividends	1,292,244	1,274,742
Holding company:		
Gross earnings	1,276,511	1,256,227
Total income	2,044,300	1,860,816
Net after tax	1,878,396	1,720,391
Surplus after charges	1,201,219	1,146,747
Balance after preferred dividends..	597,232	552,724

COMMONWEALTH POWER, RAILWAY & LIGHT COMPANY

	1917	1916
October gross .....$	1,763,894	$ 1,458,380
Net earnings	752,442	731,381
Surplus after charges	196,749	231,858
Balance after preferred dividends..	106,984	143,898
Ten months' gross..	15,905,165	13,718,662
Net earnings	7,065,472	7,026,809
Surplus after tax and charges	1,775,721	2,087,249
Balance after preferred dividends..	878,241	1,246,254
Twelve months' gross	19,149,109	16,518,224
Net earnings	8,626,649	8,565,523
Surplus after tax and charges	2,340,214	2,641,290
Balance after preferred dividends..	*1,264,559	1,640,295

*Equal to $16.80 on the common stock.

WISCONSIN-MINNESOTA LIGHT & POWER COMPANY

Earnings for twelve months ended October 31, 1917, compare as follows:

	1917	1916
Gross earnings	$1,645,307	$1,254,008
Net after tax	859,670	671,202
Surplus after charges	575,849	*
Balance after preferred dividends..	284,649	*

*Not given.

AMERICAN WATER WORKS & ELECTRIC COMPANY

Report of the American Water Works & Electric Company, for the three months ended September 30, 1917, compares as follows:

	1917	1916
Three months' gross*	$3,210,258	$2,743,345
Net	376,595	400,153
Surplus after charges	173,567	200,349

*Comprises $1,219,936 from water works properties, and $1,990,322 from West Penn Traction properties.

STANDARD GAS & ELECTRIC COMPANY.

Earnings of subsidiaries compare as follows:

	1917	1916
Northern States Power Company.		
October gross .....$	644,547	$ 546,489
Net	280,329	312,070
Twelve months gross	6,955,250	5,907,764
Net	3,514,205	3,275,387
Oklahoma Gas & Electric Company.		
October gross .....$	165,151	$ 169,410
Net	50,784	63,798
Twelve months' gross	2,450,192	2,262,334
Net	851,538	834,982
San Diego Gas & Electric Company.		
October gross .....$	137,299	$ 125,943
Net	63,346	56,352
Twelve months' gross	1,551,181	1,524,078
Net	712,952	746,026
Western States Gas & Electric Company.		
October gross .....$	114,652	$ 103,274
Net	43,986	46,714
Twelve months' gross	1,366,862	1,226,642
Net	632,420	586,933

Public Utility Dividends.

Allis-Chalmers Manufacturing Company's board of directors has declared dividends of 1¾ per cent for the quarter ending December 31 and ¾ per cent on account accumulated dividends on the preferred stock, payable January 15, 1918, to preferred stockholders of record at the close of business, December 31, 1917. Checks for such dividends will be mailed to the holders of voting trust certificates for preferred stock of record December 31. Transfer books will not be closed.

Manhattan Electric Supply Company, Inc., has declared the regular dividend of 1 per cent on common and 1¾ per cent a share on first preferred stocks. Dividends are payable January 2 to stock of record December 20.

United Light & Railways Company's board of directors has declared a dividend of 1½ per cent on the first preferred stock and a dividend of 1 per cent on common stock, payable out of the surplus earnings on January 2, 1918, to stockholders of record at the close of business December 15, 1917.

Twin City Rapid Transit Company has declared the regular quarterly dividend of $1.75 on preferred and $1.50 a share on common stocks, both payable January 2 to stock of record December 14.

Buffalo General Electric Company has declared a quarterly dividend of 1¾ per cent on the common stock, payable by check at the close of business December 20.

Springfield Railway & Light Company has declared the regular quarterly dividend of 1¾ per cent on preferred stock, payable January 2 to stock of record December 14.

Colorado Power Company has declared its regular quarterly dividend of 1¾ per cent on preferred stock, payable December 15 to stockholders of record November 30.

Southern Utilities Company has declared the regular quarterly dividend of $1.75 a share on the preferred stock, payable December 31 to stock of record December 18.

El Paso Electric Company has declared its quarterly dividend of $2.50 a share on common stock, payable December 15 to holders of record December 2.

San Joaquin Light & Power Corporation has declared a dividend of $1.50 a share on preferred stock, payable December 15 to stock of record November 30. The company paid two dividends recently of $1.50 each, one on June 15 and one on September 15 of this year.

Arkansas Valley Railway Light & Power Company has declared its regular quarterly dividend of 1¾ per cent on the preferred stock, payable December 15 to stockholders of record November 30.

Oklahoma Gas & Electric Company has declared its regular quarterly dividend of 1¾ per cent on the preferred stock, payable December 15 to stockholders of record November 30.

New York Edison Company has declared its regular quarterly dividend of $1.75 a share, payable December 14.

Public Service Corporation of New Jersey has declared its regular quarterly dividend of 2 per cent, payable December 30 to stock of record December 15.

Northern Ohio Traction & Light Company, a subsidiary of Northern Ohio Electric Corporation has asked permission of the utilities commission to issue $1,000,000 five-year 6 per cent notes to sell at best terms available, proceeds to reimburse the company for expenses already incurred.

Electric Storage Battery Company has declared a dividend of $1 per share from the net earnings of the company on both common and preferred stocks, payable January 2, 1918, to stockholders of record at the close of business December 17, 1917.

Central States Electric Corporation has declared the regular quarterly dividend of 1¾ per cent on the preferred stock, payable December 31 to stock of record December 10.

Utilities Securities Corporation has declared a regular quarterly dividend of 1¾ per cent on the preferred stock, payable December 27 to stock of record December 17.

WEEKLY COMPARISONS OF CLOSING-BID PRICES OF SECURITIES OF LEADING ELECTRICIAL COMPANIES.

Quotations furnished by F. M. Zeiler & Co., Rookery Bldg., Chicago.

Public Utilities—	Div. rate. Per cent.	Bid Dec. 4.	Bid Dec. 11.
Adirondack Electric Power of Glens Falls, common	..	15½	15½
Adirondack Electric Power of Glens Falls, preferred	6	68	68
American Gas & Electric of New York, common	10+extra	85	86
American Gas & Electric of New York, preferred	6	41	40
American Light & Traction of New York, common	..	224	214
American Light & Traction of New York, preferred	6	93	93
American Power & Light of New York, common	4	40	40
American Power & Light of New York, preferred	6	72	72
American Public Utilities of Grand Rapids, common	..	25½	26
American Public Utilities of Grand Rapids, preferred	6	58	58
American Telephone & Telegraph of New York	..	105	101¼
American Water Works & Elec. of New York, common	..	5	4½
American Water Works & Elec. of New York, particip	7	8	9
American Water Works & Elec. of New York, first preferred	..	57	57
Appalachian Power of Bluefield, common	..	2½	2½
Appalachian Power of Bluefield, preferred	7	18	18
Cities Service of New York, common	+extra	209	206
Cities Service of New York, preferred	6	73¼	73
Commonwealth Edison of Chicago	8	102	103½
Comm. Power, Railway & Light of Jackson, common	4	36	36
Comm. Power, Railway & Light of Jackson, preferred	6	63	63
Federal Light & Traction of New York, common	..	4	1
Federal Light & Traction of New York, preferred	..	25	28
Illinois Northern Utilities of Dixon	6	76	76
Middle West Utilities of Chicago, common	2+2 extra	28	28
Middle West Utilities of Chicago, preferred	6	57	56
Northern States Power of Chicago, common	ex. div.7	62	63
Northern States Power of Chicago, preferred	ex. div.7	85	85
Pacific Gas & Electric of San Francisco, common	5	34	35
Pacific Gas & Electric of San Francisco, preferred	6	81	80½
Public Service of Northern Illinois, Chicago, common	7	73	73
Public Service of Northern Illinois, Chicago, preferred	6	88	88
Republic Railway & Light of Youngstown, common	4	23	21
Republic Railway & Light of Youngstown, preferred	6	55	52
Standard Gas & Electric of Chicago, common	..	4½	4½
Standard Gas & Electric of Chicago, preferred	6	20	20
Tennessee Railway, Light & Power of Chattanooga, common	..	2½	2
Tennessee Railway, Light & Power of Chattanooga, preferred	6	10	10½
United Light & Railways of Grand Rapids, common	4	27	27
United Light & Railways of Grand Rapids, preferred	6	59	60
Western Power of San Francisco, common	..	10	9
Western Power of San Francisco, preferred	6	40	40
Western Union Telegraph of New York	extra	81	77
Industrials—			
Electric Storage of Philadelphia, common	4	49	48
General Electric of Schenectady	8	129	122¼
National Carbon of Cleveland, common	8	56½	56
National Carbon of Cleveland, preferred	..	130⅝	130
Westinghouse Electric & Mfg. of Pittsburgh, common	5+extra	38	36¾
Westinghouse Electric & Mfg. of Pittsburgh, preferred	7	..	56

*Last sale.